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Digital Inclusion Across the Globe: What Is Being Done to Tackle Digital Inequities?

Editors

Bianca C. Reisdorf and Colin Rhinesmith

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Digital Inclusion Across the Globe: What Is Being Done to Tackle Digital Inequities?

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Editorial

Digital Inclusion as a Core Component of Social Inclusion

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Abstract
There is a large body of research that has examined digital inequities, inequalities, and divides—i.e., those countries, communities, and individuals digitally left behind or disadvantaged. Whereas we know quite a lot about what is lacking and for whom, there is less focus on what works to alleviate these inequalities and divides in a variety of cultural contexts. This thematic issue brings together scholarship on digital inclusion initiatives and research from over 20 countries and in the context of numerous aspects, including different types of initiatives as well as different types of target audiences for these initiatives. Each article provides unique insights into what does and does not work in various communities, making recommendations on what could be done to improve the examined initiatives. We hope that the breadth and depth of articles presented here will be useful not just for academic audiences seeking to broaden their understanding of digital inclusion and 'what can be done' rather than focusing on 'what is amiss,' but also for policymakers and digital inclusion initiatives who are eager to expand and advance their digital inclusion work within their communities.

Keywords
digital inclusion; international; mixed methods; policy; practitioners; social inclusion

Issue
This editorial is part of the issue "Digital Inclusion Across the Globe: What Is Being Done to Tackle Digital Inequities?" edited by Bianca C. Reisdorf (University of North Carolina at Charlotte, USA) and Colin Rhinesmith (Simmons University, USA).

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1. Introduction

There is a large body of research that has examined digital inequities, inequalities, and divides—i.e., those countries, communities, and individuals digitally left behind or disadvantaged. This research has shown that first-level divides (material access), second-level divides (skills and uses), and third-level divides (outcomes of differentiated access and use) persist, even in well-connected countries where the majority of the population is online (e.g., van Deursen, Helsper, Eynon, & van Dijk, 2017). Other studies have shown that mobile Internet access can help many people access the Internet in countries that lack wireline infrastructure—so-called mobile leapfrogging—albeit allowing a narrower range of activities and skills in comparison to access from a variety of devices (e.g., Reisdorf, Fernandez, Hampton, Shin, & Dutton, 2020; Tsetsi & Rains, 2017). Whereas we know quite a lot about what is lacking and for whom—which has become especially apparent during the current COVID-19 pandemic—there is less focus on what works to alleviate these inequalities and divides in a variety of cultural contexts. The aim of this thematic issue is to bring together scholarship on digital inclusion initiatives and research from various countries and in the context of numerous aspects, including different types of initiatives as well as different types of target audiences for these initiatives.

Digital divide and inequality research has a long history of focusing on who is using the internet and who is not (Norris, 2001; Rogers, 2001), differences in how

people use the internet (DiMaggio & Hargittai, 2001; DiMaggio, Hargittai, Celeste, & Shafer, 2004; Hargittai & Hinnant, 2008; van Deursen & van Dijk, 2014), who displays what kinds of internet skills (Hargittai, 2001; Hargittai & Dobransky, 2017; van Deursen & van Dijk, 2011), and how these differences in access, usage, and skills affect people from various different backgrounds (Gonzales, 2016; Gui & Büchi, 2019; Kvasny, 2006; Ono & Zavodny, 2007; van Deursen & Helsper, 2018; van Deursen et al., 2017). Yet other research has focused on what is preventing people from making any or full use of the internet, as well as the social and community supports that individuals and families rely on to be successful in their digital adoption and use (Helsper & Reisdorf, 2013, 2017; Katz & Gonzales, 2016; Rhinesmith, Reisdorf, & Bishop, 2019). While all of these studies are illuminating the issue of digital divides and inequalities, most publications in this area do not move beyond providing relatively broad policy recommendations.

In comparison to the plethora of publications that are available on digital inequalities and the issues they create, there is relatively little work on what kinds of initiatives are trying to address these digital inequalities and inequities, who they work with, and whether they have the intended impact. While there are some notable exceptions to this rule (Rhinesmith, 2012, 2016), most available studies focused on Western backgrounds and cannot be generalized to other populations. This thematic issue is trying to bridge this gap in the literature by collating studies that are focusing on digital inclusion initiatives across various different countries from five continents: Asia, Africa, Europe, North America, and South America. The articles cover a variety of different initiatives, some of which are broad in their aims and clientele, and some are narrower in focus and in the clientele that they focus on. Bringing together these diverse studies from all around the world allows us to learn from some of the best practices in digital inclusion initiatives, providing a toolkit for policymakers and practitioners who are working to reduce digital inequities in their communities.

2. Digital Inclusion

Digital inclusion can be defined as "the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies" (National Digital Inclusion Alliance, 2017). This includes reliable access to internet at adequate speeds, access to digital devices that meet the users' needs, access to digital skills training, technical support, and content, apps, and software that are "designed to enable and encourage self-sufficiency, participation and collaboration" (National Digital Inclusion Alliance, 2017). In other words, while the "digital divide" pertains to the gap between those with and without access to the internet, and "digital literacy" focuses on the skills and abilities needed once access is available, digital inclusion more often focuses on the actual policies implemented to "close the digital divide and promote digital literacy" (Jaeger, Bertot, Thompson, Katz, & DeCoster, 2012, p. 3).

Digital inclusion has become a core topic for policymakers across the globe. The issue of digital inclusion as a core component of social inclusion has come to the forefront at time of writing this article, as the fast-spreading respiratory virus COVID-19 has confined millions of people across the world to staying at home, working, schooling, and living remotely, by means of utilizing the internet. This need for social isolation has led to renewed discussions about the now starkly visible digital inequalities and inequities (Samms, 2020; Woolley, Sattiraju, & Moritz, 2020) that have existed all along. In addition to numerous media outlets discussing this issue and internet service providers scrambling to provide free or affordable internet for school children, students, and low-income populations (Internet Essentials, n.d.) the US Congressional Research Service has released a briefing on the digital divide during this pandemic to Congress and its committees (Rachfal, 2020).

As dependence on digital devices and reliable internet increases, it is also becoming more and more obvious that being digitally excluded also means that this person is socially excluded. However, digital inclusion does not necessarily directly translate into social inclusion. Gradations in what internet users can do with their access vary with regards to their socio-demographic background and offline resources (Helsper, 2012; Livingstone & Helsper, 2007), what kinds of devices they can afford and maintain (Gonzales, 2016), where they can access the internet, e.g., whether they are depending on mobile data plans or access through an internet service provider (Reisdorf et al., 2020), and other factors, such as digital skills (van Deursen & van Dijk, 2011) or attitudes toward technologies in general (Dutton & Reisdorf, 2019). Accordingly, digital inclusion activities cannot follow a one-size-fits-all approach—especially when we move the focus beyond the US or European context.

2.1. Shifting Focus from Deficits to Initiatives

In an academic context, the term digital inclusion has most often been equated with digital inequalities, albeit providing more solution-based, i.e., inclusion-focused, perspectives. However, many publications in this area are, nonetheless, concerned with what is missing (Helsper, 2008; Livingstone & Helsper, 2007), rather than with the activities that could enable digital inclusion and thereby alleviate digital inequities. In the early years of digital inequality research as well as in more recent years, there have been calls to move digital inclusion scholarship away from deficit-based approaches and toward more asset-based approaches that focus on the assets that are available within a community, that can help alleviate digital inequities (Pinkett, 2000; Reisdorf & Rhinesmith, 2018; Turner & Pinkett, 2000). As is evident in the articles that are part of this thematic issue,

focusing on what is possible, rather than what is missing, can provide a unique and refreshing perspective that enables researchers to move beyond what the problem is and toward identifying potential solutions in regard to increasing digital inclusion.

3. Overview of Articles

The articles presented in this thematic issue cover a wide range of countries, population groups, and initiatives. The first few articles are concerned with specific factors that can contribute to digital inclusion, namely social support (Asmar, van Aduenhove, & Mariën, 2020), digital literacy (Radovanović et al., 2020), and devices (in this case mobile phones; Shema & Garcia-Murillo, 2020). We then move toward specific digital inclusion initiatives, such as the maker movement (Unterfrauner, Hofer, Pelka, & Zirngiebl, 2020), and toward programs and initiatives that are concerned with specific groups of the population, including women (Arroyo, 2020), people with intellectual disabilities and their care takers (Heitplatz, 2020), school children (Huang, Ball, Cotton, & O'Neal, 2020) and young people (Calderón Gómez, 2020), and finally older internet non-users (Gallistl, Rohner, Seifert, & Wanka, 2020). The thematic issue closes out with an overview of various digital inclusion initiatives across the Americas and the Caribbean (Robinson et al., 2020).

Based on qualitative data collected in Belgium, Asmar et al. (2020) examine patterns of social support in relation to digital inequalities. Their work reveals the diversity of support networks and support seeking patterns. The rich qualitative results also show that the availability of potential or actual support as well as the quality of support is influenced by socio-economic factors as well as the strength of the relationship and the level of intimacy between individuals. Focusing on digital literacy, Radovanović et al. (2020) demonstrate the importance of key performance indicators for digital literacy programs and sustainable development. Drawing from digital literacy initiatives for low-income and low-literacy populations in India, Kenya, Senegal, Mali, Burkina Faso, and Tanzania, they show that audio and icon-based interfaces, and the Internet lite standard could help low-literacy populations overcome limitations and acquire digital skills to foster digital inclusion. Shema and Garcia-Murillo (2020) focus on the role of mobile phones in expanding social capital in a quantitative case study of mobile phone use and call data in Rwanda. Their large-scale data analysis of call records shows that calls are primarily made within specific income level groups, contributing to maintaining the status quo. However, they also find that the middle-level poverty group can serve as a link between groups facing extreme poverty and those are financially better off. Focusing on gender as a factor affecting digital inclusion, Arroyo's (2020) qualitative study of a lifelong learning program for women in Spain explores how digital inclusion promotes the reconfiguration of time in women's everyday lives. The results show that although digital inclusion does not automatically lead to a more egalitarian allocation of time use for women, it places greater value on women's free time.

The thematic issue then moves on to specific digital inclusion initiatives. Looking at various maker spaces across Europe, Unterfrauner et al.'s (2020) qualitative study examines the potential of maker movements tackling social inequalities. They identify various domains in which makers address social inclusion by mediating skills and competences in the field of digital technologies, and in the broader sense of empowering people to 'make' solutions; by providing democratized access to digital fabrication and the knowledge on how to use them; and by ambitions articulated by makers to change society and social practices towards a society providing better opportunities for individuals. In contrast to this positive digital inclusion outcome, Heitplatz's (2020) article shows that despite the desires of people with intellectual disabilities to improve their digital skills, caregivers in Germany experience multiple barriers that prevent them from supporting their clients in achieving digital literacy. Building on the results of this qualitative study, this article develops a guideline with ten main points for designing education programs for people with disabilities, caregivers, and social institutions.

In their article on ICT development of elementary school children in the Southeastern US, Huang et al. (2020) demonstrate what does work for the development of computer skills as well as computer self-efficacy. Direct experiences with using computers have strong impacts on students' technology efficacy and STEM attitudes, emphasizing the importance of students' enactive learning experiences. Calderón Gómez (2020), on the other hand, shows that additional factors are at play in young people's technological socialization experiences. His qualitative study with youth in Spain demonstrates that self-motivation towards using digital technologies is mandatory to achieve digital inclusion, but social practices, academic and professional literacy might work as a secondary socialization process.

Next, Gallistl et al. (2020) examine policies that address older adults' Internet (non-)use in Austria and characteristics of older Austrian non-users. Their quantitative analysis shows that technology adoption is a domestication process that takes place in the everyday lives of older adults. Accordingly, policymakers and initiatives seeking to increase digital inclusion need to base their strategies on more refined understandings of Internet use and non-use in later life. We close out this thematic issue with a multi-national study by Robinson et al. (2020) that examines digital inclusion initiatives across nine countries in the Americas and the Caribbean: Uruguay, Chile, Peru, Brazil, Mexico, Cuba, Jamaica, the US, and Canada. Building on experiences across these various countries, the authors find that addressing the trifecta of digital inclusion—network, device, and skills provision—can be highly effective if implemented early on, such as in an ed-

ucational context. The authors then provide additional and timely context and suggestions on the importance of digital inclusion during the COVID-19 pandemic.

4. Conclusion

Overall, this thematic issue aims to provide a broad and international account of factors that affect digital inclusion and initiatives that seek to increase digital inclusion across various different countries and regions. Each article provides unique insights into what does and does not work in various communities, making recommendations on what could be done to improve the examined initiatives. We hope that the breadth and depth of articles presented here will be useful not just for academic audiences seeking to broaden their understanding of digital inclusion and 'what can be done' rather than focusing on 'what is amiss,' but also for policymakers and digital inclusion initiatives who are eager to expand and advance their digital inclusion work within their communities—be it at local, state, or country level. As the COVID-19 pandemic has made issues of digital inequities especially apparent, we hope that the work presented here can aid in determining what can be done to increase digital inclusion both in the short term and in the long term.

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Conflict of Interests

The authors declare no conflict of interests.

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Article

Social Support for Digital Inclusion: Towards a Typology of Social Support Patterns

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Abstract
This article contributes to a better understanding of patterns of social support in relation to digital inequalities. Based on an extensive qualitative study, the diversity of support networks and supports seeking patterns are unveiled. A typology of six patterns of help-seeking is presented and described: the support-deprived, the community-supported, the supported through substitution, the network-supported, the vicarious learners, and the self-supported. The article also critically engages with the often unnuanced academic literature on social support. The research and the typology reveal that the quality of support, as well as the availability of potential or actual support, is not only influenced by socio-economic factors. Rather, the strength of the relationship and the level of intimacy between individuals is an important predictor of support-seeking. As such, this article shows that mechanisms of in/exclusion are highly social, as they entail a diversity of formal and informal support-seeking patterns, which in turn have an important influence on the adoption and use of digital media. The article argues that understanding such mechanisms is rooted in reconciling micro-level interactions to macro-level patterns of inequalities. To show the specificity of social support within digital inequalities research, and to demarcate the concept from definitions of other academic disciplines, the concept of social support for digital inclusion is introduced. It is defined as the aid (emotional, instrumental, and informational) that an individual receives from his/her network in his/her use of digital technologies.

Keywords
age typology; digital divide; digital inclusion; digital inequalities; help-seeking; internet use; social inclusion; social support

Issue
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1. Introduction

According to Cobb (1976), social support is information that leads the subject to believe that (s)he is cared for, and that (s)he belongs to a social network of communication. Others define social support either as a flow of emotional concerns, instrumental aid, information or appraisal (House, 1987), or an aggregate of interpersonal interactions facilitating the flow of information between people (Islam et al., 2018). Looking specifically at digital inequalities, recent research shows that social support has an important effect on mechanisms of digital in/exclusion (Mariën & Baelden, 2016; Mariën & Prodnik, 2014; Mariën & van Audenhove, 2010). Indeed, given that not everyone has access to the same level of support, social support is another level at which digital inequalities manifest themselves. However, despite extensive research on digital inequalities and their consequences on mechanisms of in/exclusion (DiMaggio, Hargittai, Neuman, & Robinson, 2001; Helsper, 2008; van Deursen, 2018; van Deursen, Helsper, Eynon, & van Dijk, 2017; van Deursen & van Dijk, 2019), digital inequalities

studies present two main shortcomings when discussing social support. On the one hand, current research has not yet provided a concise definition of the concept of social support, and without a clear definition, the concept of social support is subject to several interpretations preventing the elaboration of a clear line of research; on the other hand, very little is known about the role of social support in mitigating or intensifying inequalities. In fact, the rare studies conducted on social support focus heavily on quantitative analyses regarding the quality and/or quantity of support (Courtois & Verdegem, 2016; Helsper & van Deursen, 2016; van Deursen, Courtois, & van Dijk, 2014). This article contributes to a better understanding of digital inequalities in two ways: It questions existing classifications by introducing a more complex typology of social support in relation to digital inclusion, and it nuances the causality between socio-economic factors and support. Our research questions are simple: (1) What are the different patterns of social support in relation to digital technologies, and (2) what influence do such patterns have on digital inequalities?

The rest of this article is structured as follows: In Section 2 we engage with the academic work on digital inequalities studies. We highlight the limitations of current research and present our own definition of social support for digital inclusion. In Section 3 we present our methodology. In Section 4 we develop our typology of six patterns of help-seeking and reflect on and confront our findings with existing literature. In Section 5 we reflect on the broader theoretical consequences of our work and consider the implications for digital inclusion policy.

2. Digital Inequalities Studies and the Concept of Social Support

Although research on ICT-adoption has shown the importance of social networks as a primary source of support (Bakardjieva, 2005; Brown & Reingen, 1987; Haythornthwaite, 2002; Stewart, 2007), the concept of social support is only recently being explored within digital inequalities studies. Van Deursen et al. (2014) examined how people deal with inadequate skills levels by identifying the sources and forms of support available to them. They investigated whether internet skills have an effect on the attainment of beneficial outcomes and whether the support sources employed have an influence in moderating these effects. Based on a large-scale representative survey, they developed a three-class model delineating the following support patterns: (1) the independents, users with low formal education, who do not need any help; (2) the socially supported, users seeking support from family and friends; and (3) the formal help seekers, users relying heavily on help desk, computer experts, or formal courses.

The results of the survey show that the independents were more likely to be male with higher education levels, while the socially supported were generally female with low levels of education and more often unemployed; the formal help-seekers were constituted of low and medium-educated users with higher levels of employment than the socially supported. Through this study, van Deursen et al. (2014) show that patterns of support-seeking have a strong influence on the development of digital skills, the benefits one is able to attain from the internet, and on the quality of the support received. However, while the study yielded interesting insights regarding the importance of support, the focus on digital skills somehow obscures the understanding of support-seeking: Why do individuals choose one form of support over another? Do people combine different patterns of support-seeking? Are inadequate skills levels the only factor motivating people to ask for help? Or are there deeper motivations prompting people to ask for help?

Courtois and Verdegem (2016) argue that social support is an indispensable source of social learning. Whereas van Deursen et al. (2014) focused on the link between digital skills and social support, Courtois and Verdegem (2016) consider the composition and socio-economic background of social support networks and their moderating role in explaining digital inequalities. Based on quantitative analysis, they delineate three main profiles: (1) the domestically networked, users who rely on others (family, friends, etc.) to help out with a problem; (2) the non-domestically networked, users who first ask for support from colleagues and friends; and (3) the self-reliant, users who rarely ask for help but solve problems on their own.

According to this study, the domestically networked were mostly older females from large families and unemployed; the non-domestically networked were younger males, financially at ease, employed, and part of smaller families; the self-reliant were younger users with the tendency to use different languages online. Two important findings can be taken from the study of Courtois and Verdegem (2016). First, those who seek support within their domestic circles are usually from disadvantaged social and economic positions, with low motivation and skills. Second, social embeddedness—that is the extent to which someone is part of a social network—is a key factor to be able to ask and receive help, showing how social and digital factors go hand in hand. While our own research confirms this second conclusion, our findings also show that those who ask for help within their domestic circles are usually those with the most social and economic resources.

Whereas both former studies establish patterns of support seeking, Helsper and van Deursen (2016) focus on quantity and quality of social support and their subsequent influence on digital engagement. To this end, they use different indicators to predict potential and actual use of support, as well as the variety of sources of support used. They distinguish between potential support—support people believe they have access to—and actual support—support people have actually used. Their findings show that informal support—also defined as the socially supported (van Deursen et al., 2014) or the

domestically networked (Courtois & Verdegem, 2016)—was more often used by people with lower levels of digital resources, whereas those with high socio-economic resources turned more easily to formal sources of help (e.g., co-workers, experts). More importantly, this study shows that social support is another level at which digital inequalities manifest themselves: Those who experience the most problems online are the ones with fewer opportunities to receive high-quality support. While our research partially supports this last conclusion, our findings show that not only those with a high level of education benefit from the use of digital technologies but some respondents in other socio-economic groups, in contrast to their peers, are able to take advantage of the use of digital technologies.

To show the specificity of social support within digital inequalities research, and to demarcate the concept from definitions of other academic disciplines, we introduce the concept of social support for digital inclusion. We define it as the aid—emotional, instrumental, and informational—that an individual receives from his/her network in his/her use of digital technologies. We define emotional aid as the support given through appraisal or social companionship during a time of heightened distress caused, for instance, by an individual's fear of technology, while informational aid is a task-oriented form of support (e.g., teaching an individual to use a computer). Informational aid refers to the guidance, advice or feedback an individual receives during the learning process. Social support for digital inclusion points thus to the diverse nature of support networks and highlights the variety of support seeking patterns people use and/or combine, from individuals without access to support networks, to individuals who gain support by emulating others. Henceforth, our definition of digital social support, while built on existing conceptualisations of social support (Cobb, 1976; Islam et al., 2018), asserts the specificity of such a concept for digital inequalities studies by being grounded in the findings of this research.

3. Methodology and Analysis

Most studies on social support as a factor in digital inclusion use quantitative methods. This article presents one of the rare qualitative studies in this field. Yet, it is important to note that social support and the patterns of help-seeking were not the initial aims of IDEALiC—Setting the Future Scene of Digital Inclusion, a research project in Belgium on which this article is based. The research project focuses on the digitalisation of public and private services in Belgium and its impact on citizens' digital autonomy. However, the discussion on support seeking emerged organically during our conversations with participants. Similarly, the patterns of help-seeking outlined below arose naturally during the qualitative analysis of the in-depth interviews.

Throughout the research, we apply a life-course perspective approach to highlight the complex and changing conceptions of individuals regarding digital technologies. The life course perspective refers to a sequence of activities or events embedded in individuals' lives. This approach aims at mapping, explaining and describing the change in social positions over time (Elder, 1994; Meyer, 2009). This approach states that individuals, at each life stage, are experiencing various life transitions. The notion of 'life stage' points to the roles and social positions an individual occupies over time, whereas 'life transitions' describe the pattern taken by these social positions over time. From this perspective, each transition corresponds to a significant 'step' in life which not only modifies an individual's social status and roles, but also affect their participation in different social spheres.

This article is based on 85 in-depth interviews with respondents distributed across three life stages (see Table 1).

The first life stage (18–30 years old), henceforth called the 1st LS, corresponds to the period in which young adults are building autonomy in all domains of the social life (e.g., employment, relationships, etc.) and are steadily increasing their social, economic and political participation in society.

The second life stage (31–50 years old), henceforth called the 2nd LS, refers to a period in which individuals are assumed to have developed a certain autonomy and participate fully in society; however, the challenge at this point is to maintain this autonomy and full participation while at the same time managing work, family, and life hazards.

The third life stage (51–70 years old), henceforth called the 3rd LS, can be characterised by the desire to remain active in society while ageing remains an important societal challenge.

Table 1. Overview of the respondents.

	18–30 Y/O		31–50 Y/O		51–70 Y/O		
	F	M	F	M	F	M	TOTAL
Low education level	3	6	2	5	6	5	27
Medium education level	3	3	5	3	7	4	25
High education level	5	4	5	6	4	8	32
Undetermined			1		1		
Total F/M	11	13	12	13	18	15	85
Total	24		26		35		

In addition to the life stage perspective, several other criteria were taken into consideration for the selection of respondents:

- The level of education: low education level (LE; maximum middle school diploma); medium education level (ME; maximum high school diploma); and high education level (HE; minimum bachelor degree);
- The family situation: in couple, living alone, living with parents;
- The presence of children: no children, children living at home, children no longer living at home;
- The social status: employed, retired, student.

The aim of these selection criteria was to have a varied range of profiles over the life trajectories. The sampling was not aimed at statistical representativeness but sought the equal representation of a wide range of individuals. The life course perspective allows us to generate new insights regarding the patterns of help-seeking and social support for digital inclusion (see Table 2). What patterns are present across the three life groups? How do these patterns intersect? Where do they diverge?

Interviews were conducted in Belgium between April–June 2017 and February–June 2018. The respondents were recruited via the networks of the research team and through posts on social media. For groups that were more difficult to reach (e.g., homeless), the research team reached out to its network of grassroots organisations to contact these respondents. Each of the 85 in-depth interviews was conducted face-to-face at the desired location of the respondent (mostly at home). The interviews were transcribed and coded using NVIVO, data analysis software designed for rich text-based data. A codebook was developed in order to ensure the efficient management of large volumes of complex data. The codebook was divided into six different themes: (1) trajectory of life; (2) conditions of access and use; (3) digital engagement; (4) autonomy; (5) outcomes; and (6) perceptions.

The codebook is based on the combination of two methods of exploring data. On the one hand, a deductive or 'top-down' approach was used starting from theories on digital inequalities (Carretero, Vuorikari, & Punie, 2017; Helsper, 2008, 2016; Helsper & Eynon, 2013; Helsper, van Deursen, & Eynon, 2015; Mariën & Baelden, 2016; van Dijk, 2005; van Deursen, Helsper, Eynon, & van Dijk, 2017) to explore the data gathered during the in-depth interviews. This theory-driven approach is observable with the fifth theme on outcomes, for instance, referring to the benefits someone is able to draw from his/her engagement online (van Deursen & Helsper, 2015). The theory-led perspective enabled the research team to identify processes not explicitly identified by the respondents.

On the other hand, an inductive or 'bottom-up' approach was used moving from the observation of concrete realities to the conceptual understanding of the data collected. This 'bottom-up' perspective allowed the research team to 'hear' the voices of the respondents through the analysis. It allowed the construction of theoretical narratives based on the interpretative and subjective nature of interviews. This approached is observ-

Table 2. Overview of the respondents: Additional criteria.

Family situation	F	M	F	M	F	M	TOTAL
	18–30 Y/O		31–50 Y/O		51–70 Y/O		
In couple	5	5	5	8	13	10	46
Living alone	5	4	4	5	8	5	31
Living with parents	3	3	0	0	0	0	6
Widow(er)	0	0	0	0	1	1	2
Total F/M	13	12	9	13	21	17	85
Total	25		22		38		
Children	F	M	F	M	F	M	TOTAL
No children	10	12	5	4	3	3	37
Children at home	2	0	5	9	1	2	19
Children not home	0	0	0	1	16	12	29
Total M/F	12	12	10	14	20	17	85
Total	24		24		37		
Social status	F	M	F	M	F	M	TOTAL
Student	5	3	0	0	0	0	8
Employed	6	9	7	7	6	1	36
Unemployed	1	1	5	6	5	2	20
Retired	0	0	0	0	7	14	21
Total M/F	12	13	12	13	18	17	85
Total	25		25		35		

able with the sixth theme on perceptions, as individuals' representations of, and relationships with technology, emerged organically during our conversations with the participants.

For the concept of social support for digital inclusion, we distinguished between support online (YouTube tutorials, online forums, etc.), support within close social networks (family, friends, colleagues), support in computer and/or technical centres, and no support-seeking. We further distinguished between those who provide support to family, friends, colleagues, those who give support online (e.g., helping strangers through online forums), and those who do not provide support.

4. Seeking Help? Towards a Typology of Digital Social Support

Based on insights from our research, we develop a typology of six patterns of help-seeking and the characteristics associated with them (see Figure 1). The aim of this typology is twofold: (1) to further the debate on social support within digital inequalities studies; and (2) to critically engage with the often unnuanced academic literature on social support. It must be noted that these patterns of support are not mutually exclusive: People combine varied forms of support to meet their needs. However, while support-seeking patterns are not exclusive, the way people switch between patterns of help or the way these patterns change over time become only visible in the long run and would necessitate observing people over the years—a task for further research.

4.1. The Support-Deprived

Individuals in the support-deprived category are characterised by their lack of access to social support. They are generally low educated coming from all three life stages. At the social level, their situation is often precari-

Type of support	Characteristics	Type of support	Characteristics
Support-Deprived	• Low level of digital skills and of often in situations of social precarity and/ or social exclusion. • Acknowledge that they need help with digital technologies but in the incapacity to find someone to help because of their situation of exclusion. • Found within all three life categories (18-years old; 31–50 years old; 51–70 years old)	**Network-Supported**	• Draw support mainly from close social circle (family/children/spouses/close friends and/or coworkers. • Show the importance of social embdedding: to be able to draw support, there is a need to be integrated in a social network. • Mostly, 2nd life category (31–50 years old) and 3rd life category (51–70 years old).
Community-Supported	• Almost all sources of support come from computer room and/or computer classes. • Computer room/classes seen as: — a way out of potential exclusion, both at the social and digital level — a way to become more independent (no longer depends on children for support) • Mostly respondents from 3rd life category (51–70 years old)	**Vicarious Learners**	• Do not explicitly ask for support but learn by emulating others. • Rely on watching friends' and family's use of digital media and from then onwards start learning by doing. • Mostly respondents from the 1st life category (18–30 years old).
Supported Throught Substitution	• Do not directly engage with digital media but ask someone in their close social circle (generally family members) to accomplish a specific task for them (e.g. send an email) • Spotted with older couples where one spouse either has more skills than the other or when one spouse does not want to use digital media. • To be distinguished between a) supported with low digital skills, and b) supported with low motivation. • Mostly respondents from late 2nd life category (41-50 years old) and 3rd life category 51–70 years old)	**Self Supported**	• Do not seek support from the domestic sphere but are a great source of support for others (mostly domestic circle). • Reveal high levels of digital skills and digital fluidity. Are more likely to stretch out of their comfort zone to learn new things. When help is needed , they look for solutions online and learn by doing. • Mostly respondents from the late 1st life category and early 2nd life category (between, 25 and 45 years old). Mostly male and highly educated.

Figure 1. Patterns of social support.

ous (unemployed, retired, chronically ill, etc.): They possess a limited—often inexistent—social network. At the digital level, their low economic resources prevent them from having access to and/or owning quality digital tools. As a result, the support-deprived are often individuals with very low digital skills. This already precarious situation is further aggravated by the fact that they do not have access to help. Indeed, while most of the respondents within this cluster acknowledge that they need help (e.g., to send an email), they also recognise their inability to ask for support when they need it. This category of respondents has not, to our knowledge, been identified in current research on social support. Support-deprived individuals lack emotional, as well as informational and instrumental aid:

> Interviewer: When you are confronted with problems with your smartphone, do you ask for help?
>
> Respondent: Most of the times I just give up. When I find myself in difficulties and I don't know how to use it, the problem is I don't have anyone near me to show me how to use my smartphone or do this or that operation with it.
>
> Interviewer: So, there are moments where you really don't know what to do and where you just give up?
>
> Respondent: Yes, it happens. And since I do not have a computer it is really not easy. (Female, 28, 1st LS, LE, living with her parents, no children, student)
>
> Respondent: I would like to be able to use it [technology in general], yes, because otherwise you are no longer part of society. It evolves so fast that it becomes impossible to follow what is happening. You are almost obliged to have this technology. And you constantly have this feeling that, yes, it is needed but [pause] if you don't have this technology you are completely left out of everything. (Female, 53, 3rd LS, LE, living alone, no children at home, unemployed)

For this category of respondents, the feeling of exclusion as well as the awareness of being pushed to the margins of society is acute. In addition, the social pressures and the sentiment of being compelled to engage with the digital is a recurrent theme within this category. On the one hand, digital evolutions occur at a rate they have difficulty following; on the other hand, the increasing digitisation of society presses them toward even more digital solutions, regardless of their inability to keep up with technological evolutions.

This confirms the findings of Courtois and Verdegem (2016) and Mariën (2016) on the impact of social embeddedness on digital engagement. The quotes from the support-deprived show how social and digital factors play a role in mechanisms of in/exclusion. Indeed, respondents in this category often expressed a sense of powerlessness. The challenges they face at the digital level impede their societal participation. It also partially confirms the findings of Helsper and van Deursen (2016) according to which those most in need of help are the ones with fewer opportunities to access high-quality support. In that sense, social support is indeed another level at which inequalities, both social and digital, are manifested.

4.2. The Community-Supported

The community-supported category refers to the individuals whose only source of support comes from computer classes, computer training organised by state/municipality-funded organisations, or digital inclusion intermediaries. In that sense, they resemble the formal help seekers of van Deursen et al. (2014), as they rely on formal help as their main source of support. However, our study shows that, for this category of support seekers, age is a more discriminant factor than education: The technically supported in this research are mainly found among respondents from the 3rd LS (51–70 years of age), with gender and education levels all taken into account. For this cluster, instrumental or task-oriented, and informational aid are important. These individuals usually display low levels of digital skills which can be explained by the fact that digital technologies are relatively new for this generation:

> Respondent: Yes, so it is not always easy. I am sixty-six and I think that for older people it is a real performance to come here to follow computer classes. To be so willing to work with the computer, I think, it is unique actually. Because you should not underestimate the difficulty, all this is quite new for our generation. (Female, 66, 3rd LS, LE, in a couple, no children at home, retired)

Despite low levels of skills, the community-supported show high motivation to learn. This motivation is expressed in two ways: On the one hand, the decision to start computer classes is motivated for some respondents by the fact that their low digital skills expose them to potential exclusion. As told by one of the participants (male, 60, 3rd LS, LE, living alone, no children, unemployed), the fear of becoming digitally illiterate, associated with a precarious socio-economic situation and the urgency to find employment, motivated his decision to start learning to use digital technologies. Indeed, due to a severe back injury, this respondent had to leave his construction job to find a less manual form of labour. This meant automatically having to engage with digital technologies on a regular basis. Another respondent says the following:

> You come to a point where you say: You really can't do without digital media. And that is…especially, when you go to the GB [supermarket], there are papers

> sometimes, but when you don't have your card with you then you have to go through the computer. Now that has been adjusted, now they do it themselves since a few days ago, but before you had to log in and do that alone. Then I think: I have to know more about it. Because you are really right there, like a layman, and you do not know how to push or pull a button. And that helped me, also those lessons here at the municipality. (Female, 66, 3rd LS, ME, in a couple, no children at home, retired)

On the other side, some respondents see in the computer classes the opportunity to become more autonomous in their digital experience. This category of respondents is generally reliant on the support of their children and they are motivated to learn new skills because they desire to be independent:

> Respondent: In the beginning, I was about forty, and they, my children, they were about fifteen or something…and yes, having to admit that you cannot do that, alas, that is hard. I can't do everything here….Bwa, it's not that bad. But, that's true, that's true: I used to be the one who could do anything here and, in those days, I had to ask my child. And so I am not used to that. (Male, 63, 3rd LS, HE, in couple, children at home, retired)

As shown by Kiesler, Zdaniuk, Lundmark, and Kraut (2000, p. 345), the dynamics of help at home can become problematic, especially when "children's technical expertise shifts intellectual expertise in the family." Henceforth, for this category of respondents, finding help in computer centres is crucial for the development of their digital skills and autonomy as it allows them to gradually gain independence from their close social networks.

This cluster deviates from categories of support patterns as defined in academic literature (Courtois & Verdegem, 2016; van Deursen et al., 2014). Help-seeking is not only activated when individuals are confronted with problems. As demonstrated by the community-supported, social support is at times a pre-emptive measure undertaken to achieve a desired need—finding a job or becoming more independent. Once again, the social context of the individual is crucial to explain the deeper motivations stimulating people to seek support.

4.3. The Supported through Substitution

Selwyn, Johnson, Nemorin, and Knight (2016) discuss the role of proxy users and their use of technology on behalf of others. We propose the supported through substitution category, which is slightly different. It refers to those users who use technology 'through' others and consists of individuals who refuse or are unable to use and/or access digital technologies. While proxy users accomplish tasks for others, supported through substitution access and/or use technology through others. In other words, supported through substitution access and/or use technology through proxy users by asking them to perform the tasks they need: printing a document, sending an email, paying taxes, etc. Hence, this category is relevant as, contrary to the proxy users who accomplish tasks on behalf of others, the supported through substitution allow us to understand the motivations of those who make use of proxy users. For this cluster, proxy users constitute a source of emotional aid, supporting them during a time of heightened stress (e.g., anxiety at the thought of using a computer), and of instrumental aid or task-oriented help. They do not resemble any existing category as, to our knowledge, this type of user has not been classified within current research on social support.

Far from being a homogenous group, their levels of education allow us to distinguish between: (1) those who have low digital skills and are subject to button-anxiety; and (2) those who are not motivated to use digital technologies.

4.3.1. The Supported through Substitution with Low Digital Skills

This category consists of individuals with low to middle education levels and found mostly within late 2nd LS (40–51 years of age) and the 3rd LS (51–70 years of age). They heavily rely on their social circle to engage with digital media:

> Respondent: I don't know my email address by heart. So now I have written it on a piece of paper, and I keep it with me. Because now I know what the consequences will be if I ever lose it again. So, I ask a good friend of mine to regularly check my mailbox with me, or I ask him to do it for me, like homework [laughs] and to check if there is something and send me an SMS if there is. It is so embarrassing. I am ashamed to find myself in this situation. It feels like I am illiterate. (Male, 49, 2nd LS, LE, living alone, no children, unemployed)

For the respondents of this category, their use of a proxy is mainly motivated by a fear of digital technologies. This fear of technology is accentuated by low levels of self-confidence, both regarding their social position and their digital capacities. Our research shows that this fear of technology is often linked to negative experiences with the digital: these respondents often have the feeling of being 'punished' for not using digital media.

Much like the support-deprived, this cluster shows the importance of social embedding. More importantly, it shows that despite the availability of support, society plays a great role in individuals' use and adoption of technology. Our findings indicate that these commonplace discourtesies—such as being fined for not using an online platform—reinforce individuals' negative perceptions of digital media and hamper the development of their digital autonomy. In that sense, society puts strong expectations upon such individuals without giving them

the tools and means to answer these expectations.

4.3.2. The Supported through Substitution with Low Motivation

The second type of supported through substitution can be found within close family circles, and more precisely with older couples (3rd LS, 51–70 years of age). In these couples, one spouse—in our study generally the woman—has more skills than the other who refuses to engage with technologies. Respondents in this group correspond to what Mariën (2016) calls the "digitally self-excluded": high- to middle-educated individuals, with a rich social network, access to digital technologies but who choose not to engage with the digital because of their lack of motivation. Commonly, lack of time and retirement are put forward as reasons for disengagement:

> Respondent: [Talking about his wife] I do not have anything against the automatization, or the fact that everything now happens digitally. I know how and what to do. But as I said, I am retired now; I was first on sick leave and then went into retirement. I could still type one or two letters with the computer but in the meantime, I have an amazing secretary [laughs] and I just let her take care of everything. She does everything I ask, for now at least [laughs]. (Male, 68, 3rd LS, HE, in a couple, no children at home, retired)

This cluster is interesting as it demonstrates that motivation and social perception of technology, more than socio-economic indicators, influence the pattern of help-seeking. It also shows that the lack of motivation is not solely linked to negative attitudes (Reisdorf, 2011); rather, some individuals do not see the value of engaging with technologies (Helsper, 2016). Yet, both types of support raise a series of questions: What happens when the proxy-user disappears? Should we help them develop their own digital skills, or find ways to motivate their engagement with technologies?

4.4. The Network-Supported

Network support is the most common form of support within our 85 respondents. Respondents from this cluster are usually middle- to highly educated, from the 2nd LS and 3rd LS. They mainly draw support from their close social network: at home with spouses and/or children, and at work with colleagues. The key concept to understand this type of support is the notion of homophily (McPherson, Smith-Lovin, & Cook, 2001). The concept of homophily refers to the idea that "contact between similar people occurs at a higher rate than contact between dissimilar people" (McPherson et al., 2001, p. 416). In other words, people tend to build their social networks around and with people who are most like themselves in terms of personal characteristics. As McPherson et al. (2001, p. 415) put it: "Similarity breeds connection."

This cluster resembles the socially-supported of van Deursen et al. (2014) and the domestically-networked of Courtois and Verdegem (2016) as they make significant use of family and friends as sources of support. However, contrary to most research on social support (Courtois & Verdegem, 2016; van Deursen et al., 2014), we place the help received from co-workers at the same level as the help received within the family. We argue that the common denominator between these seemingly different sources of help resides in the strength of the tie uniting individuals. In fact, our research shows that individuals will only ask for help from close co-workers they feel they can trust and consider part of their close social networks. Moreover, individuals asking for help at work usually rely on friends and family when the support from co-workers is unavailable. In comparison to other categories, this group is able to rely on a large network of family, friends, and co-workers and is capable of combining different forms of help—informational, instrumental, and emotional:

> Respondent: Yes, looking for help….If I need help with software or something like that, I will more easily ask a colleague I know well, like: Hey! Do you know how this and that works? But yeah, for the rest I just ask my girlfriend sometimes, but I think that's just it. (Male, 48, 2nd LS, HE, in a couple, children at home, employed)

> Respondent: Oh, usually I ask Natasha or Kristof [co-workers], Kristof most of the time because he is good with this sort of stuff and he knows what to do. So, I go to them with my problem and I just ask: Hey, can you help me find a solution? And in last resort, I go to the IT-helpdesk of the bank, but they are almost all external to the bank, so I don't do it often. (Female, 57, 3rd LS, HE, in a couple, no children at home, employed)

As observed by Courtois and Verdegem (2016), network-supported in the context of the workplace are generally financially secure with stable employment. In line with van Deursen et al. (2014) and Stewart (2007), this cluster reiterates the crucial role of the workplace as a locus of help. This cluster also demonstrates how personal offline resources can be translated into the digital world with the appropriate support, and the importance of social capital. The concept of homophily associated to the concept of social support for digital inclusion shows partially how the rich—in terms of social, cultural, and economic resources—keep getting richer by accumulating and translating social resources into digital resources. In fact, the aforementioned respondent acknowledges that, as a result of the high-quality support from her co-workers, she noticed that her use of technology was becoming more intuitive. She still faces specific difficulties but manages more easily to solve problems on her own this cluster makes evident that social support is another level at which mechanisms of in/exclusion are per-

vasive (Helsper & van Deursen, 2016). Unlike the support-deprived individuals who lack the social embedding necessary to ask and receive help, or the supported through substitution with right resources but the low motivation, the network-supported, because of their deep social inclusion, are able to face specific digital challenges by asking for help.

At home, the network-supported tend to draw support mostly from their children and spouses. Contrary to the studies of Courtois and Verdegem (2016), or Helsper and van Deursen (2016), our research shows that those relying on family and friends do not necessarily come from a disadvantaged position, nor do they exhibit low digital skills. Rather, specifically for this research, our findings suggest that those relying on family and friends are usually respondents with a mid to high education level, financially secure and generally employed. Moreover, network-supported in the family context do not typically score low in terms of digital skills; instead, they make use of their social network to solve very specific problems:

> Respondent: No, I will first try to do things by myself, try to discover things by myself and test things for a while. Sometimes it works well and other times I need help with something in particular. So, if I try and it does not work and I see that it is taking me too much time, I just ask my younger son, yes, I still have one son at home. He studies at the VUB [university], bioengineer. So, when he is home, I just ask him, otherwise, there is always one of them [his sons] that I can ask for help. (Male, 66, 3rd LS, HE, widower, children at home, retired)

> Respondent: My husband used to pay all our bills and when he died, I stayed almost one year going all the time to the bank to do my bank transfers. Everyone was always telling me how easy it was to do everything online, but no one ever showed me. And one day, my daughter came home, and she sat for an hour with me and showed me how to do it. Now I feel almost stupid when I think of how much difficulty I had before. (Female, 68, 3rd LS, ME, widow, no children at home, retired)

Network-supported in the context of family support the findings of several studies (Bakardjieva, 2005; Chu, 2010; Correa, Straubhaar, Chen, & Spence, 2013; Stewart, 2007), emphasising the role of the family as source of support, and the importance of intergenerational exchanges of knowledge (Dolničar, Hrast, Vehovar, & Petrovčič, 2013). This category also raises questions regarding the sustainability of such a form of support. For some respondents, learning in a family context is perceived as frustrating as family members—most often children—do not always have the time or the motivation to help. This frustration often results in a strong need to be self-sufficient in their use of technology and a desire to be independent of their children's help. As such, network-supported in the context of the family are also very often the community-supported:

> Interviewer: Could you give a specific example of your daughter not wanting to help?

> Respondent: Let's say that something happens. Something pops up on the bottom of my computer or my mailboxes. I'm always afraid to open it because I don't know what might happen if I click on it. My daughter just tells me 'When you don't know don't touch' but…I don't want to be dependent anymore. That's the reason why I go to the EPN [public computer centre] with my computer to ask questions. (Male, 46, 2nd LS, ME, in a couple, children at home, employed)

4.5. The Vicarious Learners

The vicarious learners are mostly found in the 1st LS (18–30 years of age), and at the beginning of the 2nd LS (31–33 years of age), middle- to highly educated. Vicarious learners express some of the characteristics of the network-supported as they rely extensively on their close social networks in order to engage with digital technologies. Nonetheless, they distinguish themselves from other patterns of support, as they gain confidence from watching the digital uses of friends and family members before deciding to use the technology themselves. Put differently, contrary to the supported through substitution, who access technologies through others, the vicarious learners learn to use technologies through others. In that sense, social support for digital inclusion takes mainly the form of informational aid for this cluster: Close social networks act as "local institutions" or "local experts" (Stewart, 2007) whose opinions and information are highly valued by the vicarious learners:

> Respondent: My mom works at Belfius [Belgian Bank], and at first I thought, yes…but such an app on your mobile with your bank details, I don't know…because with your money…imagine if someone steals your phone or imagine you are hacked, then that person can get all your money. But then my mama told me no, no, [that] it is very safe, and you have to do that and that and that. So actually, I am always afraid of something happening with my cell phone, but then if there is someone who can convince me that it is not true, then I have no problem, then it works for me. (Female, 25, 1st LS, HE, in a couple, no children, employed)

> Respondent: So, yes, I don't have a particular interest in this or that. I mean, I'm not going to go and download an app just to see how it works, no, no. For example, when I hear my friends say, oh…that, for instance, now that Payconiq [electronic payment] app is booming, and that is usually how it happens, so If I hear from friends, say: Oh, J., the app is abso-

> lutely great! Yes, then I would probably try that in the long term, yes, yes. But testing things in itself is not in me. (Male, 33, 2nd LS, ME, living alone, children at home, unemployed)

Once the vicarious learners are convinced of the validity or usefulness of digital tools, they start discovering the digital by themselves through trial and error. They remain a strong basis of support for the less-skilled members of their social networks and are often the source of help of the network-supported. The question this cluster raises is whether this self-learning approach is beneficial for the development of their digital skills. As noted by van Deursen and van Dijk (2010), while people may learn effectively by trial and error, they also tend to reproduce the same mistakes online once they achieve the goals they have in mind. In that sense, contrary to the following pattern of support, which shows high levels of skills from the beginning, vicarious learners run the risk of building questionable and weak skills when learning by doing.

4.6. The Self-Supported

Self-supported learners are the least common type. They can be compared to what van Deursen et al. (2014) called "the independents," and to what Courtois and Verdegem (2016) call "the self-reliant." The self-supported do not ask for help, although they possess the network to do so. Instead, they seem to learn intuitively, revealing high levels of digital skills and digital autonomy. The self-supported are generally male, highly educated, aged between 25 and 45 years old and working closely with digital media. In general, they have high-quality access and equipment. They tend to move out of their comfort zone to learn new things and are confident about their skills. While the vicarious learners also learn by doing, the self-supported differ from this typology in the sense that they rarely wait for a local expert's approval before trying new technology, and they exhibit high levels of digital skills form the start:

> Respondent: I will easily try something out if it is new or if I hear something from friends, or I see someone with it and…it seems cool. Sometimes I test also to see if that suits me and if it fits in with my way of working. (Male, 35, 2nd LS, HE, in a couple, children at home, employed)

> Respondent: Photoshop, for example, is something that I like, it is a hobby I learned by myself years ago. And there are always new versions and when I have to make something with Photoshop sometimes it's true, I don't know where to start so I just browse tutorials on YouTube. The same for my music software: I can go on the website of the software or look on forums what other users are saying, but…yes, I don't see the need to ask others because I know how to look for stuff by myself. (Male, 44, 2nd LS, HE, in a couple, children at home, employed)

Self-supported learners constitute a prominent source of support for their social network. They form the support basis for network-supported and vicarious learners: They are often the co-workers, the digital experts giving in-house training, the children helping the parents or the local experts of the vicarious learners:

> Interviewer: And can you recount a moment where you provided help to someone else?
>
> Respondent: Yes, definitely my grandparents: helping them with their computer, printing stuff on one page instead of two, helping with emails, downloading stuff and helping them find what they have downloaded, installing Dropbox on their computers and explaining to them how it works. Yes, actually helping a lot in the family with like real concrete stuff. (Male, 25, 1st LS, HE, living with parents, no children, employed)

The concept of homophily again plays a significant role, as high-quality support tends to be given within highly homogenous social networks. As shown by Yuan and Gay (2006), homophily has a strong influence on the creation of learning communities. As the likelihood of social interactions increases among similar people, so does the formation of network ties when it comes to learning communities. By assisting their social environment, self-supported act as gatekeepers in the distribution of knowledge, thus enabling the people in their environment to develop their digital skills and autonomy. Policy interventions should consider this type of support as a pathway to the digital inclusion of those lacking the resources to ask for and receive help.

5. Conclusion: Digital Social Support and the Question of Inclusion

As mentioned in Section 4—in which we have described our typology—we have constantly reflected on and confronted our findings with existing academic literature. We will not repeat this here. In this section we explore the broader theoretical implications of our work and point to consequences for policy. It is clear by now that digital inclusion is not just a technological issue; rather it entails a variety of formal and informal sources of help enhancing or constraining access to and use of technologies.

Our concept of social support for digital inclusion allows us to rethink digital inclusion in two main ways. At a theoretical level, the concept of social support for digital inclusion reveals how individuals develop various ways of coping with learning in a society in constant change. Indeed, rapid technological evolutions are progressively transforming all realms of society, requiring individuals to learn and/or update their skills at a faster rate than

before (Asmar, van Audenhove, & Mariën, in press). The role of social support for digital inclusion in coping with fast-paced learning is evident in two ways:

- Support networks are not only invoked in time of heightened stress or when individuals are faced with difficulties. As highlighted by the community-supported, some respondents reached out to their support networks in a pre-emptive manner. In fact, some respondents were acutely aware that certain life transitions were threatening their digital inclusion in the long run (e.g., having to find a new job when having low digital skills). As such, these respondents reached to their support networks at a very early stage of their learning process to avert the consequences of potential exclusion;
- Social support is not only invoked by individuals with low digital skills. As demonstrated by the network-supported, the vicarious learners, and to some extent, the self-supported, social support is often used by individuals seeking to resolve very specific problems. To do so, they resort to distinct persons in their networks (e.g., co-worker) and once their problems are solved, they are able to resume their learning process.

Highlighting these ways of coping with learning in a fast-paced society allows demonstrating first the agency of our respondents in choosing which moments are the most beneficial to make use of their support networks. Second, this agentic behaviour shows that respondents are highly aware of the potential outcomes attached to the use of their networks (e.g., better skills to find a better job). However, we contend that these outcomes still have to be explored and better understood by digital inclusion researchers. We are confident that such a shift would benefit digital inclusion researchers by opening up a research agenda that is less focused on socio-economic indicators as factors of social support, and more centred on understanding the different outcomes people are able to gain from the use of support networks.

Concerning inclusion initiatives and policies, we argue against traditional approaches on digital inequalities considering being digitally included as an individual responsibility (Mariën, Heyman, Salemink, & van Audenhove, 2016; Wauters, Mariën, & van Audenhove, in press). As outlined in this contribution, the individuals who were able to access and benefit the most from social support—supported through substitution with low motivation, network-supported, vicarious learners, self-supported—were the ones included in dense social networks. Indeed, contrary to most quantitative studies on social support (Courtois & Verdegem, 2016; van Deursen et al., 2014), our research shows that those with high education levels are not always the only ones on the right side of the digital divide—that is to say the ones able to benefit the most from their use of digital technologies in their everyday life (Buente & Robbin, 2008). Our findings reveal that some lower-educated respondents, contrary to their peers, find themselves on the right side of the divide as well. Despite their difficulties, social and/or digital, they show high interest and motivation to engage with digital technologies. This positive disposition is translated in conscious efforts to develop their skills through computer classes, by asking for help or through trial and error. Moreover, quantitative studies on social support tend to rely heavily on socio-economic and socio-cultural factors as indicators of the quality or availability of support. Yet, our findings suggest that the quality, as well as the availability of potential or actual support, is also influenced by the strength of the relationships between individuals. Put differently, intimacy is an important predictor of support that needs to be taken into account in typologies of support-seeking. As such, it is important at the policy and community level to recognise these social interactions in which digital inclusion can flourish: the learning communities in computer classes, in the workplace, within the familial circle.

Conflict of Interests

The authors declare no conflict of interests.

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Article

Digital Literacy Key Performance Indicators for Sustainable Development

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Abstract
The concept of digital literacy has been defined in numerous ways over the last two decades to incorporate rapid technological changes, its versatility, and to bridge the global digital divide. Most approaches have been technology-centric with an inherent assumption of cultural and political neutrality of new media technologies. There are multiple hurdles in every stage of digital literacy implementation. The lack of solutions such as local language digital interfaces, locally relevant content, digital literacy training, the use of icons and audio excludes a large fraction of illiterate people. In this article, we analyse case studies targeted at under-connected people in sub-Saharan Africa and India that use digital literacy programmes to build knowledge and health literacy, solve societal problems and foster development. In India, we focus on notable initiatives undertaken in the domain of digital literacy for rural populations. In Sub-Saharan Africa, we draw from an original project in Kenya aiming at developing digital literacy for youth from low-income backgrounds. We further focus on Senegal, Mali, Burkina Faso and Tanzania, where field studies have been conducted on the use of digital technologies by low-literacy people and on how audio and icon-based interfaces and Internet lite standard could help them overcome their limitations. The main objective of this article is to identify key performance indicators (KPIs) in the context of digital literacy skills as one of the pillars for digital inclusion. We will learn how digital literacy programmes can be used to build digital literacy and how KPIs for sustainable development can be established. In the final discussion, we offer lessons learned from the case studies and further recommendation for stakeholders and decision-makers in the field of digital health literacy.

Keywords
digital inclusion; digital inequalities; digital health; digital literacy; health literacy; Internet lite; key performance indicators; sustainable development goals

Issue
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1. Introduction

In our modern era, Information and Communication Technology (ICT) has been a key dominant factor in bringing innovation change and sustainable development. Sustainable development is the first key concept in this article. The concept has been defined in many different ways in the body of knowledge but, at its core and in practice, it requires the integration of economic, environmental and social objectives across sectors, territories and generations (Emas, 2015).

In this article, we are referring to the sustainable development concept as understood in the terms of the United Nations Development Programme (2017), best known as the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. The leading SDGs framework for international cooperation officially came into force in 2016, proclaiming access to the Internet as a basic human right and fundamental for achieving the SDGs. Each of the 17 SDGs has specific targets to be achieved by 2030 and, in this article, our focus is on the relation of digital technologies and SDG3 Health and SDG4 Education.

Digital technologies play an important role in providing insights into people's activities, opinions, health and everyday lives. Digital health, the second key concept in this article, refers to the use of digital technologies for health and is used as an overarching umbrella for eHealth including mHealth (World Health Organization [WHO], 2019a, p. X). However, there are almost four billion people who do not yet have access to such digital public goods, Internet and basic information on health and education. The digital divide is primarily relevant for people that are unable to access or afford technology due to certain characteristics like gender, socioeconomic category, place of residence (urban/rural), and levels of literacy (Hargittai & Hinnant, 2008; Radovanović, Hogan, & Lalić, 2015).

As many scholars have noted, the digital divide is also a divide of literacy and skills (Radovanović et al., 2015; van Dijk, 2005; Warschauer, 2002). Therefore, Internet access is still seen as a necessary condition for sustainable development and many people could more practically engage with the technology if they had the basic skills. In the fourth industrial revolution, digital literacy presents a crucial empowering agent in a governmental, economic and educational setting, as work and personal lives become increasingly technologised. Thus, digital literacy is needed for providing sustainable development and is the relevant factor for bridging this digital divide. Similarly, health literacy is used to describe people's abilities to engage with health information and services (Dodson, Good, & Osborne, 2014, p. 1) and plays an important role in accelerating towards the SDGs (WHO, 2016).

Another key concept, and challenge, is that there are no universal key performance indicators (KPIs) for certain aspects of digital society development. Therefore, there is an urgent need for framing and developing KPIs for digital literacy. However, there are several issues here, such as how sustainable development is defined, and whether one is measuring the level of sustainable development or the consequent impact of the sustainable development on aspects of society (Radovanović & Noll, 2017).

This article aims to identify KPIs for sustainable development related to digital literacy. The research questions we are posing here are how digital literacy programs can be used to build knowledge and health literacy, and in the context of digital literacy, how KPIs for sustainable development can be established.

The article is organised as follows: After reviewing the KPIs in the sustainable development and digital literacy context, we present the case studies that developed the KPIs for sustainable development in various country contexts from Sub-Saharan Africa and India. Throughout the article, we present the methodology in regard to each case study, and the main findings in each, discussing the learned lessons. Finally, we provide a conclusion and further recommendations that could be useful for further research and development of the KPIs for digital literacy and digital transformation centres.

2. Literature Review

This section addresses the definitions of KPIs in the social context and the digital literacy skills definition in the current technological surroundings, through the literature overview.

A KPI is defined as a set of criteria and measures focusing on the aspects of institutional, individual or project performance that are critical for the success of the organisation or a project. KPI Management has been widely practised by numerous organisations and companies in recent years and, therefore there is a need for more representative performance measures and metrics to reflect the performance of new digital environments.

A performance measurement system plays an important role in managing projects as it provides the information necessary for decision-making and actions. It is essential to measure the dynamics in sustainable development environments so that timely action can be taken. The purposes of measuring project and organisational performance are (1) to identify the success of the project, (2) to help the organisation understand its processes, confirm what they know or reveal what they do not know, (3) to examine if the stakeholders' needs are being met, (4) to identify where problems exist and where improvements are necessary, and (5) to show if planned improvements actually took place (Gunasekaran & Kobu, 2007; Parker, 2000).

The KPIs approach has also been used to set up frameworks for the assessment of the impact of knowledge management on organisational performance in education (Rodrigues & Pai, 2005), business (Carrillo, Robinson, Anumba, & Al-Ghassani, 2003), and other settings. According to Day and Bobeva (2006), in education,

KPIs are used to meet the objectives and strategic plans of a high education institution. Cox, Issa, and Ahrens (2003) differentiate between quantitative and qualitative measures of success. Their qualitative performance indicators include safety, turnover, absenteeism and motivation. Sohail and Baldwin (2004) carried out a study in low- and middle-income countries in which they offer 67 performance indicators related to socio-economic issues such as enterprise development, poverty alleviation, and empowerment. Despite the extensive research and progress in other areas (industry, management, economy), there is no general agreement on a set of KPIs for sustainable development and digital inclusion projects to date, and the current research in measurement for social projects is relatively limited.

Therefore, there is a need for identifying and establishing the KPIs for measuring relevant sustainable development factors such as digital literacies and implementing them into sustainable infrastructures. Regardless of these limitations, it is important to identify, clarify and frame the perception of KPIs in different types of research and development projects carried out in different contexts to share the best practices and to expand the existing frameworks of KPIs for future projects.

Literature review shows that the performance measurement of managerial and social-related projects is slowly moving away from traditional measures such as cost, time and quality towards a mix of quantitative and qualitative measures.

3. Digital Literacy and KPIs

The theoretical understanding of digital literacy is expansive in its purview, encompassing various facets of human-technology relations. Some of these incorporate skills and competencies while others harness multi-literacies, adaptation and creation viewed through various intersecting new media-connecting devices. A decade ago, some scholars such as Haythornthwaite (2007) stressed that digital literacy requirements include competencies in finding, processing, producing, and communicating information, and it also implies fluency in online technologies, communication norms, and programming environments. Needless to say that defining digital literacy is beyond the scope of this article, as ideas and initiatives around digital literacy keep changing according to the needs of individual low- and middle-income countries. However, these overarching theoretical understandings have often been incorporated in various definitions as well as country frameworks, especially in high-income countries. To this end, UNESCO (2018) set up a task force to define and measure digital literacy. After a thorough review of national frameworks from more than 43 countries across all regions, the following definition was adopted:

> Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital devices and networked technologies for participation in economic and social life. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy. (UNESCO, 2018, p. 21)

This standard definition embodies many important facets of widely accepted theoretical models of digital literacy life skills, competencies, critical thinking and knowledge creation. We can distinguish the following types of digital literacy skills: formal operational skills to navigate the Internet, information retrieval and analytical skills, content creation skills and media literacy skills. We believe that various dynamics and forms of digital divide will intervene differently in each of these skills. In Ireland, there is the incorporation of concepts like coding, programming, computational thinking, logic and critical thinking into the concept of digital literacy (Smith, 2017). Digital literacy, as seen in most high-income countries, incorporates multiliteracies/multimodal dimensions—which are the technical, cognitive, and social-emotional dimensions. Under the rubric of 'multiliteracies' or multimodal literacies, frameworks are shaped and expanded, and thereafter KPIs of digital literacies are developed to measure and analyse the success of sustainable development. For example, in the widely used digital capability framework (used in the UK), seven elements of digital literacy are included in the capability framework. The framework is developed around the idea of digital literacy as 'capabilities' emphasising on digital citizenship along with notions of identity, wellbeing, rights and responsibilities (Brown, 2017). According to Llewellyn (n.d.), this framework can be seen as a strategic management toolset designed to help companies innovate leading to enable business transformation and help companies analyse their current situation. Similarly, the digital competence framework widely used in European countries (DigComp 2.1; see Carretero, Vuorikari, & Punie, 2016) identifies five components of digital competence. Keywords like competencies, literacies, skills, and capabilities play a crucial role in conceptualising the idea of digital literacy and KPIs related to projects or initiatives. Most national frameworks in the low- and middle-income countries like India and Kenya conceptualise digital literacies only around the idea of competency and skill, which is too narrow a set of competencies, often creating narrow KPIs.

These different understandings of digital literacy emphasise two key points: Firstly, KPIs will vary according to the definition, framework and goals of the country through which initiatives and projects are run. There is no one-size-fits-all digital skills assessment for measuring the success of implemented programmes (Radovanović & Noll, 2017). Secondly, a comparison of the KPIs of the low- and middle-income countries with high-income countries or an imitation of KPIs from high income countries may be problematic as it may completely de-

contextualise the former. The socio-economic and cultural contexts of low- and middle-income countries are different. Furthermore, understanding the heterogeneity of countries is important, but that would not be enough to create a solid KPI framework unless the heterogeneity of programmes and projects is well understood. Deconstructing the KPIs is crucial in understanding and creating them.

In the following sections, we will go into detail on how KPIs have been established after casework in the Global South. The cases were selected as a result of a longstanding collaboration with various actors in the projects that aimed to implement digital literacy to achieve SDG3 and SDG4 and further digital transformation. We analyse case studies targeted at underconnected people in Sub-Saharan Africa and India that use digital literacy programmes to build knowledge and health literacy, solve societal problems and foster development. In India, we focus on notable initiatives undertaken in the domain of digital literacy for rural populations. Despite being one of the faster-growing economies in the world, there is a visible gap between rural and urban literacy rates, there is also a wide gap between male and female literacy levels. India ranks as low as 134 in the ICT Development Index ranking out of a total of 176 countries (International Telecommunication Union, 2017). India's literacy rate is close to 74% (Census 2011, n. d.). Functional literacy rates might be much lower given the potentially questionable measuring mechanism of this national data today.

In Sub-Saharan Africa, we draw from an original project in Kenya targeted at developing digital literacy for youth from low-income backgrounds. According to data from the Communications Authority, internet penetration in Kenya is at 90% with 51.1 million users. The government has a long-term development plan that aims to transform the country into a knowledge-based economy by utilising ICTs for development and growth (PMO Kenya, 2017). This is an opportunity to leverage youth and utilise human capital to raise labour productivity.

We further focus on Senegal, Mali, Burkina Faso and Tanzania, where field studies have been conducted on the use of digital technologies by low-literacy people and on how audio and icon-based interfaces and the Internet lite standard could help them overcome their limitations. West Africa has experienced significant progress in mobile service usage over the past few years, but it remains behind other emerging markets. Unique mobile Internet users represent 26% of the population, nearly doubling over two years (2017–2018) but remains below the penetration rate in Lower-middle income countries (33%) and comparable to the Sub-Saharan African average (22%; GSMA, 2019). Finally, Tanzania is facing a growing number of people connected to Internet and communication services, especially through mobile technology, with 42% of the population subscribing to a mobile service in 2018, and more than 8 million new mobile Internet subscribers added since 2010 (GSMA, 2019). However, the rural-urban gap in Internet connectivity is widening; while 86% of rural citizens have no access to the internet, 46% are connected in urban areas (Research ICT Africa, 2017).

In Section 4, we briefly present and synthesise each of the methods used in case studies respectively. The detailed case studies are presented in the following sections.

4. Methodology

Case studies from India focus on two nation-wide digital literacy initiatives—the first initiative, PMGDISHA, undertaken by the Government, and the Spoken Tutorial initiated at the Indian Institute of Technology Bombay using a self-learning method. These two case studies were selected as they have different objectives and methods of imparting digital literacy—the first used the offline and trainer-based method, exposing digital skills to low-literate people, and the other used the self-learning hybrid method (online and offline) to impart the digital skills to students who wanted to learn different skills by themselves. We used the secondary resources and the existing literature for these case studies. In the study we have answered two research questions: how digital literacy programs can be used to build knowledge/education and digital skills and how KPIs for sustainable development can be established.

The Tunapanda case study in Kenya uses empirical data obtained by the Tunapanda Institute and employs a mixed-method approach. The data were tested by qualitative thematic analysis and presentation guided by theoretical tools and approaches obtained through desktop analysis and library research. The case study observes how youth employability and entrepreneurship can be used as KPIs in digital literacy initiatives. The study observed 362 youths who graduated from the Tunapanda program and their pathways following the program.

The case studies from West Africa use ethnographical methods. The Senegal study relies on a field experiment conducted by Zouinar and Ndiaye (2015) surveying 20 low-literate mobile phone users between 22 and 52 years of age. Based on a literacy assessment, they are classified into three levels of literacy: illiterates (7; users who have never been to school, are unable to read and write in any language but can have some numeracy skills), semi-literates (10; users who left school very early or went to Arabic school, who can read, understand and write simple phrases in one language and have basic numeracy skills) and advanced semi-literates (3; users who can read, partly understand and write complex sentences in Arabic, French or Wolof). Other experiments present a qualitative survey based on interviews conducted with four subjects corresponding to the first two levels of low-literacy described in Section 7.1, illiterate and semi-literate. These subjects are recruited from recent Malian immigrants in France and can call and use some phone features such as the camera, radio and music. The case study in Burkina Faso uses a focus group ap-

proach to investigate the use of digital financial services.

In Tanzania, the researchers designed a community-based non-randomised controlled study, as a method, to test the effect of a digital health intervention (DHI) within the "Non-Discriminating Access for Digital Inclusion" project (hereafter only DigI project). A questionnaire with 42 disease-specific health-knowledge questions was developed before quantitative data collection. At the moment, the study is on-going with 596 recruited participants. So far, only preliminary results from the first stage are available. Data collection will end in May/June 2020. Findings will indicate the diseases-specific health literacy level in the two groups, intervention (N = 298) and control (N = 298), before and after implementation of the DHI. The participants are followed for one year.

In the following sections, we are presenting detailed case studies from India, Kenya, West Africa, and Tanzania.

5. Case Studies from India

5.1. PMGDISHA and Spoken Tutorial: An integrated Approach to Digital Literacy

Digital literacy has become an essential tool for the economic and social development of people's lives. However, achieving digital literacy is a challenging task due to socio-economic factors like low literacy levels (Bureau, 2018), poverty, inadequate local content, absence of infrastructure and social inequalities. Therefore, there have been several efforts to equip the digitally illiterate rural population with digital literacy training, including the National Digital literacy Mission (NDLM) launched in 2014, the Pradhan Mantri Gramin Digital Saksharta Abhiyan, also known as Prime Minister's Village Digital Literacy Mission (PMGDISHA) in 2017, and Spoken Tutorial in 2009. The analysis of these notable initiatives will help identify the current KPIs and help establish KPIs that could be relevant for future project performance to enhance digital literacy in low- and middle-income countries such as India and bridge the digital gap between urban and rural areas.

5.1.1. PMGDISHA

This was a digital literacy initiative by the Government of India to make 60 million rural people digitally literate by March 2019. In this scheme, one member from each household in the village is digitally illiterate, in the age group 14–60 years, to undergo 20 hours of digital literacy training. As an outcome, the learner should be able to understand the basics of digital devices, browse the Internet, carry out a cashless transaction, etc. The competencies of learners are assessed through an online evaluation test consisting of 25 questions which is conducted by a national certifying agency. This performance test focuses on testing the information retention of the learners without any evaluation of digital skills. This reduces the accuracy of the results.

As PMGDISHA reaches a large-scale rural population belonging to a diverse socio-cultural background, skill-testing becomes a challenging task. There is an unavoidable trade-off between the cost-effectiveness of the resources deployed and the accuracy of the test. Accuracy is dependent on the questions framed, the environment in which they are conducted, adequate training of the trainers and the ability to apply these skills in daily life.

In the case of PMGDISHA, KPIs needs to be integrated from the beginning of the project instead of relying only on assessment studies or social auditing. The impact assessment study conducted by the Council for Social Development for NDLM (a precursor of PMGDISHA), wherein three KPIs were used to measure the success/failure of the implementation. These three KPIs were (1) whether trained candidates can use the digital devices effectively, (2) analysis of the day-to-day application usage and (3) the ability to use digital devices after training. Other qualitative benefits include improvement in confidence levels, knowledge and awareness.

As a large-scale project, PMGDISHA must have an in-built feedback and monitoring mechanism to evaluate every stage in the project. This can be done by integrating KPIs based on outcomes and user appreciation in the project. Similarly, the user appreciation-based indicator would help to fine-tune project components such as the training of trainers, training materials to cater to diversity in literacy, knowledge levels, and other socio-economic parameters of the leaners.

5.1.2. Spoken Tutorial

The Spoken Tutorial project began at the Indian Institute of Technology Bombay in 2009 to promote IT literacy for education and employment for college students. The tutorials consist of a 10-minute-long audio-video tutorial using screencast technology. These tutorials aim to teach various programming languages like C++, Java, Python, graphic and circuit design tools amongst others to a target population consisting of students, working professionals, and teachers. According to Moudgalya (2017), screencast technology creation policies produce a flexible and easy web-based e-learning experience by including elements like free and open source software, pedagogy of self-learning for beginners, low bandwidth and small screen devices, accessibility without Internet. Due to its flexible approach, it has been used in 36000 college lab courses, and ten universities have announced they will be using screencast technologies for their lab courses. Apart from user-friendly content policy and methods, there is accentuation that Web-based e-learning comes with its shortcomings, highlighted through user feedback. Feedback comes from a Web-based e-learning systematic usability scale questionnaire and self-efficacy questionnaires which are based on the KPI called 'user appreciation.' The user appreciation indicator is used to know whether the project satisfies the needs of the user. In the case of screencast technologies, this indicator is used to

understand how the learners perceive and understand the tutorials.

Eranki and Moudgalya (2012) presented a study on the relationship between behavioural interventions and user preferences while using screencast technologies. Participants were divided into novice and experts based on a pre-test questionnaire and their Web-based-e-learning preferences were identified using the systematic usability scale questionnaire. Using a systematic usability scale, 20 questions are framed to understand user preferences and experiences in using STs (Eranki & Moudgalya, 2012, p. 42). Based on learner preferences, five feature sets were identified: layout, search, interface, link/buttons/menus, and alphabetical Index. These were classified and clustered into different categories. The study showed that clusters which comprise of novices, preferred single-page interface, standard colour layout, study plan index, search filters and dynamic drop down as compared to the cluster which denotes experts, who preferred multipage, multi-colour, study plan index and dynamic dropdowns (Eranki & Moudgalya, 2012, p. 42). User centrism of this indicator leads to the optimisation of project parameters, thereby leading to maximum output.

5.2. KPIs for Self-Sustainable Development

Dale and Newman (2005) found in their study that universal development requires a complex interdisciplinary approach beyond what is found in traditional environmental education. In diverse socio-economic and cultural contexts, digital literacy can be successfully leveraged to reach out to a greater number of students, including those to whom education was previously not easily accessible, and help to promote learning, as well as exposing students to the technical skills required for many occupations (Budhedeo, 2016). Integrating the KPIs from the beginning of digital literacy imparting projects will help to measure the performance-based assessment, knowledge-based assessment, and self-assessment of the learner (Carretero et al., 2016). KPIs specifically designed for digital literacy will increase the knowledge in each domain, including education, access to health services and improving livelihoods, which can be mapped at household and village levels.

Programs with integrated KPI like PMGDISHA and Spoken Tutorial will not only give exposure to digital skills but also allow learners to improve their ability to utilise their digital skills in a meaningful way. These kinds of participatory and community-oriented skilling programmes enable first-generation learners to have greater access to education, health and information services, thus improving their lives. Going forward, combining the basic digital literacy program PMGDISHA with Spoken Tutorial from the beginning of student life would transform the digital education system and prepare youth for the future. If both the government and other sectors join hands with such community-oriented initiatives, 53 million livelihoods will be created by 2021, assuming a job-to-user ratio in India of 1:10 and a local language Internet user population of 536 million by 2021.

6. Case Study on Digital Literacy Skills Training for Youth in Kenya

6.1. The Digital Skills Gap in Kenya

A report released by the International Labour Organization in 2018 warned that unemployment levels are rising more than job creation and economic sustainability. Kenya has a working-age population of 25.5 million, which translates to over half the country's total population. This number is projected to swell to 39.2 million by 2035. Yet, one in every five Kenyan youth of working age is unemployed. In Nairobi alone, unemployment stands at 14.7%, with more women (19%) compared to men (11%) living without a job. While formal sector employment did grow in Sub-Saharan Africa since 2000, this development unfortunately lagged behind population growth, resulting in fewer opportunities in the formal labour market for the increasing numbers of Africa's young school and university graduates.

Youth living in urban slums face additional barriers such as poverty and gender, making them least suited to reap the benefits of digital inclusion. In Kibera for example, the lack of affordable internet access and devices, and being limited to no digital capabilities lock out these youths who have the potential to gain digital skills that can give them access to entry-level digital jobs.

Regarding gender inequality, the labour force participation for women stands at a global average of 54% compared to 81% for men. This has implications in internet connectivity, going by the available figures. For instance, on connectivity, nearly 45% fewer women than men have access to Sub-Saharan Africa (Intel Corporation, 2013).

The solution for these challenges implies, firstly, job creation. Equipping youth with skills to become entrepreneurs, improve access to financing, and championing small and medium-sized enterprises will help increase opportunities to earn and save. Secondly, skilling the workforce and skills development in STEM and ICT are key components in Sub-Saharan Africa's transformation and economic growth. Thirdly, closing the gender gap is crucial. Although there are many interventions to bridge the digital gap, there is a need to invest in equipping youth with skills that will enable them to look for employment and create opportunities for wealth and jobs both locally and globally.

6.2. The case of the Tunapanda Institute

The Tunapanda Institute is an ICT vocational training centre in Kenya's largest urban informal settlement, Kibera. Started in 2014, the organisation runs three-month digital skills training for local youth aged between 18 and 30 years. The program aims to close the digital divide in

Kibera by ensuring the youth can get entry-level jobs in ICT or start ICT-based entrepreneurial ventures. The organisation receives over 300 applications for the training program but is only able to accommodate 30 trainees per cohort. Access to quality education is a major challenge in Kibera with 80% of the schools being community-owned schools that are heavily under-resourced and lack basic classroom infrastructure. This not only results in high dropout rates in primary and secondary school while those who manage to finish high school may not be able to enrol at university due to the high cost of education and high cut-off grades. Thus, Tunapanda looks for youth who, despite their previous grades, have a growth mindset, ability to lead and work in teams and have clarity as to why the training would be beneficial. The project-based curricula focus on equipping the youth with employable and entrepreneurship skills in technology and digital design. These are buttressed with soft skills such as communication, growth mindset, and personal branding. The first month of the program focuses on technology; the trainees are taken from basic computer skills to more advanced skills in becoming digital creators. The modules mainly focus on web and mobile development. The second month blends the design thinking methodology and is followed by design in the second month, which adopts the design-thinking methodology for the design of digital products such as websites and mobile applications. In the third month, the trainees focus on building products for the community around them. They take part in researching challenges faced by the community and designing relevant and sustainable solutions. The trainers also focus on preparing steps after graduation depending on the trainee interests and the Tunapanda pathway model. The program encourages peer-to-peer learning through sharing of computers and team projects. The teams have weekly presentations to their fellow trainees who give them constructive feedback, which helps with confidence-building.

6.2.1. Digital Literacy KPIs

Kenya does not have a framework for digital literacy KPIs. The definition has mostly been guided by workforce requirements, which is competence in the use of ICTs. However, this definition is limiting as it leaves out other forms of literacy, such as the ability to create digital content, digital identity, online privacy and safety.

Through thematic analysis and direct observations and outcomes after the program trainees went through, Tunapanda developed a set of indicators to measure the success of the training program against the following KPIs:

- Number of graduates joining the Tunapanda journeymen program;
- Number of graduates in employment;
- Number of graduates joining start-up incubator programs.

6.2.1.1. Number of Graduates Who Complete the Journeymen Program

Tunapanda invites applications from a set number of trainees to join the organisation's apprenticeship program. Some 15–20% of graduates join the 8-month program in which they are mentored in an area in which they would like to develop expertise and is relevant to the organisation's mission. They also become coaches supporting the trainers for the next two cohort programs. After successful completion, they join the journeymen program where they become trainers and also work on the organisation's income-generating activities. Currently, 97% of the organisation's team are graduates of the program and contribute not only to the training program but also to 75% revenue generated to run the organisation.

6.2.1.2. Number of Graduates in Employment

Over the years, Tunapanda has developed partnerships with local companies enabling the organisation to place graduates into employment. The organisations send the graduates' resumes to potential employers and arrange for interviews. Successful candidates can secure jobs and Tunapanda charges placement fees to the employer. The graduates can get entry-level jobs in market research for digital products, customer service, and technical support. Tunapanda has several success stories of graduate placement with 68% of the graduates being employed.

6.2.1.3. Number of Graduates Joining Start-Up Incubator Programs

The third pathway is entrepreneurship where graduates are placed in start-up incubators. Tunapanda has partnered with Somo Africa, a social enterprise incubator in Kibera. The program provides training, mentorship and start-up capital for these budding entrepreneurs. The organisation has also supported three female graduates in joining a one-year technology and entrepreneurship start-up incubator program in Ghana. Two of the women's start-up ventures were funded after completion of the program.

6.2.2. Replicability

Tunapanda Institute's model was initially designed for replicability at a minimal cost. By empowering learners to quickly become coaches and trainers, Tunapanda's model lowers barriers to entry in the training profession and lowers costs for schools to run. The model also avoids competition for technically-enabled teachers, which is a big problem in low-income regions. By working with other organisations, the model generates robust and replicable processes for setting up, running and growing advanced digital training facilities even in the most remote of areas. One successful mission has

been with the Learning Lions Project (IT education for remote Africa) in Turkana, a remote part in Northern Kenya, where two graduates of Tunapanda Kibera successfully launched a clone of the program. By distributing and creating only open source software and open learning resources, the Institute minimises costs for replication and empowers people to customise the curricula to suit their local contexts. Tunapanda's KPIs aim to ensure that the program graduates have better earning and learning opportunities, for improved livelihoods.

Digital literacy is the key to ensuring the effective use of ICTs and digital media. The Kenya case study shows that it can contribute to not only building a skilled workforce but also to increased earnings and igniting entrepreneurship among youth. This directly contributes to SDG4, SDG5, SDG7, SDG10 and SDG11.

Although there is anecdotal evidence of the global spread of internet connectivity, there is little empirical data that captures the reality of this phenomenon in Kenya regarding the uptake, infrastructural development, policy formulation and implementation on matters of internet connectivity in Kenya, the involvement of various actors, and how marginalised groups such as the youth are involved in these processes. The current case study fills this gap. In other words, this case study contributes to country-specific literature on the opportunities available as well as the uptake of digital literacy.

Specifically, the case study demonstrates the viability and impact of tech hubs in the Kenyan context; it shows the relationship between skills obtained in such contexts and employability and suggests measures to be taken if challenges associated with the foregoing are to be overcome.

7. Case Studies on the Uses of Mobile Services in West Africa

In this section, we present two case studies, one from Senegal and another from Burkina-Faso, to illustrate how low-literacy users overcome their limitations and the potential of voice, or sound more generally, to increase their use of mobile phones.

7.1. Mobile Voice and Text Usage among Low-Literacy People in Senegal

This subsection reports the main findings from an ethnographic study conducted in Senegal by Zouinar and Ndiaye (2015). The study aimed to understand how literacy affects the use of a mobile phone to design new devices and services that can be used by individuals with a low level of literacy.

Three patterns of usage corresponding to the three levels of low literacy have been identified: basic use, limited use and quasi-autonomous use. Basic use consists of very limited usage of mobile phone, mainly receiving calls from family members, friends and clients. Some basic users can make a call from the call history or notebooks. Others can play music or radio on the phone. However, they do not use text messaging or the contacts list. Limited use involves receiving and making calls but not using a text message. Some limited users manage contacts or require assistance from close relatives or friends to use other features such as changing the phone settings, reading, writing or sending text messages. Quasi-autonomous use is associated with users who can read, write and send text messages. However, they need to rely on literates to write complex messages.

It turns out that low-literates develop strategies to overcome their limitations. They rely more on voice than text. This is consistent with the findings from a study conducted by Chipchase (2008) in Asia (India, China and Nepal) which suggests that illiterate mobile users can call and answer incoming calls but cannot use features that require text editing. They rely on memorisation and the use of proximate literates to assist in phone use. These findings suggest that access to ICT is less affected by individuals' level of literacy. However, usage intensity could be affected. Therefore, digital literacy KPIs should put more emphasis on the abilities needed to use ICT services.

7.2. Using Sonification to Increase the Use of Mobile Services

This section reports the results of two experiments that assess the impact of sonification on the use of mobile services.

The first experiment was conducted by Zouinar and Boyer (2016) to evaluates the effectiveness of a new user interface that embeds voice in the local language (Bambara) and explicit icons to save contacts, write SMS, dial a phone number, initiate a call and use the list of contacts. Two types of voice assistance were proposed: one that delivers a message to assist the user in doing an operation with their phone (e.g., saving a contact), and another that links vocal messages with icons to make them understandable to the user.

However, these experiments are very limited in the usage of text message and the Internet. Each was subjected to six scenarios:

- Saving a contact following a call;
- Saving a contact from the call history;
- Selecting a predefined SMS and sending to contacts from the phonebook;
- Initiating a call from the list of contacts;
- Dialling a phone number;
- Identifying a series of icons.

The main findings suggest a strong potential of vocal assistance to support the use of ICT by low-literacy individuals. Subjects showed a strong preference for vocal assistance, especially in their mother tongue, suggesting that digital literacy KPIs should include the ability to use vocal communication channels to interact with ICT services.

The second experiment uses a focus group approach to investigate the use of digital financial services in Burkina Faso (Le Ravazet & Pringent, 2017). It aims at evaluating the impact of a sound-based prototype of a mobile-money App on usage. The sound-based prototype includes audio-icons, whereby a sound is emitted as the users are about to touch it.

Two samples of users were constructed: a treatment group of 6 individuals who use the sound-based prototype and a control group of 4 individuals who use the typical mobile-money App. The following six scenarios were tested:

- Entering the secret code;
- Viewing the account balance;
- Making an international transfer;
- Topping up airtime;
- Paying a bill;
- Making a national money transfer.

It turns out that sonification has a positive and significant impact on the usage of mobile-money services, the number of participants that successfully passed all scenarios without any assistance is greater in the treated group than in the control group.

These case studies highlight two considerations for the measurement of digital literacy in a low-literacy context:

- Heavy reliance on voice rather than text;
- Reliance on proximate literates.

Regarding the reliance on proximate literates, it means that the assessment of digital literacy skills should go beyond the settings of a specific individual and encompass the skills of other individuals with whom he/she interacts. The surveys conducted in Senegal suggest that low literate people typically rely on literate members of their households or close friends.

However, these specificities are likely to act as constraints regarding the use of ICT for formal or confidential purposes, such as contracts and financial transactions. Therefore, as suggested by the experiments conducted with Malian diaspora and in Burkina Faso, service innovations could be a relevant complement to lower the barriers to using digital services for low-literates.

8. Case Study on the Digi Project in Tanzania

The previous sections in this article have elaborated on digital literacy in general; this part will be more specific on the concepts of digital health and health literacy.

The DigI project is a multi-disciplinary project that installs small WiFi information spots providing digital information in rural Tanzania, in areas previously not connected to the Internet. Basic and affordable equipment is installed in local houses, schools, health facilities or centres to connect the villages. The main objective of the study is to assess disease-specific health knowledge six months after part two of the DHI has been rolled out. The number of correct answers pre and post-exposure will be analysed using McNemar's test. Knowledge scores will be calculated with the answers from the multiple-choice sections and linear regression models will be used when analysing the results. The scores will be adjusted for the confounders: age, education and gender.

8.1. The DigI Project and DHI

The actual information spot provides free access to a catalogue of whitelisted pages on the Internet (with text and pictures) and locally stored information, for example, digital health messages. The users also have premium access to heavier webpages, with video streaming, for example. This sustainable and inclusive internet-for-all solution is called Internet lite (Basic Internet Foundation, 2018). Each project village has its local network control centre, as well as a village server, allowing all use of Internet lite in the village to be free of charge.

Internet lite can be accessed either with own smartphones or tablets for public use, located in the information spots. The DHI consists of two parts: (1) a single-time exposure to digital health messages in an animated video format and (2) free access to digital health messages locally stored in a community information spot. The intervention aims to increase health literacy related to specific diseases of public health importance, such as HIV/AIDS, tuberculosis, *Taenia solium* cysticercosis/taeniosis and anthrax. These are called intervention diseases. The results of the study will be converted into a set of KPIs and are related to (1) the knowledge gained after exposure to the digital health messages, and (2) the knowledge retention resulting from the use of the community information spot.

The digital health messages are provided in several formats, like animated health videos, audio clips, text, pictures and quizzes. They are finalised and to be found online (DigI project, 2020). A screenshot of the web prototype is provided in Figure 1.

The health contents were developed together with physicians, veterinarians, IT professionals, web designers, local communities and digital health researchers and are in line with national guidelines (Ministry of Health, Community Development, Gender, Elderly and Children Tanzania, 2017) and strategy plans (Ministry of Health and Social Welfare Tanzania, 2015; PMO Tanzania, 2015). In the DigI team, the importance of locally relevant content and a local language digital interface in Tanzanian Kiswahili is emphasised. When accessing the digital health messages, users are provided with basic information related to five relevant domains of the intervention diseases:

- Prevalence, to create local visibility about the particular disease;
- Cause/transmission, on how the diseases spread and infect others;

Figure 1. Screenshot from the web prototype developed in the DigI project.

- Symptoms, to promptly detect and treat the diseases medically. The digital health messages encourage and motivate people to seek medical advice if symptoms appear, and will provide contact details to the nearest health clinic;
- Treatment, to show how patients can live healthy lives with the right treatment;
- Prevention, on how people can protect themselves, their families and how to prevent the disease from spreading between individuals and/or in the communities.

The overall goal of increasing health literacy is better disease management, disease prevention, better use of health care services and ultimately the reduction of morbidity and mortality. Sørensen et al. (2012) has captured this in a proposed model for developing health literacy enhancing interventions, as shown in Figure 2. This model is demonstrating the different dimensions of health literacy and shows the link between health care, disease prevention and health promotion.

As shown in the model, it is also expected that the DHI at a broader level will have an impact on health service use, which again affects health costs, health behaviour and following health outcomes, participation and empowerment, as well as equity and sustainability. However, these are all outcomes that are extremely costly and time-consuming to monitor, measure and evaluate, and would altogether require a study design with a large population enrolled for years beyond the project frame. In the DigI project, the effect of the DHI is measured in relation to knowledge uptake and knowledge retention pertaining to the inner circle representing an arrow in Figure 2 and therefore in more feasible ways, with follow-ups over a year, eventually suggesting KPIs for disease-specific health literacy from knowledge uptake and knowledge retention.

The DigI project further addresses two important aspects of health literacy according to Figure 2, above—access to and understanding of the digital health messages, which can ultimately lead to the appraisal and application of the information. Digital health is essential to achieve sustainable health systems with universal health coverage (WHO, 2019b).

8.2. The Most Important Outcome: Transforming Results from a Controlled Study into KPIs

The intervention group was exposed to the digital health messages in an animated health video format, once, just after baseline knowledge questions had been asked. Questions were repeated right after this exposure. This first round will provide KPIs on knowledge uptake by comparing baseline knowledge scores with immediate after exposure knowledge scores in the intervention group and adjusting for changes in the control group.

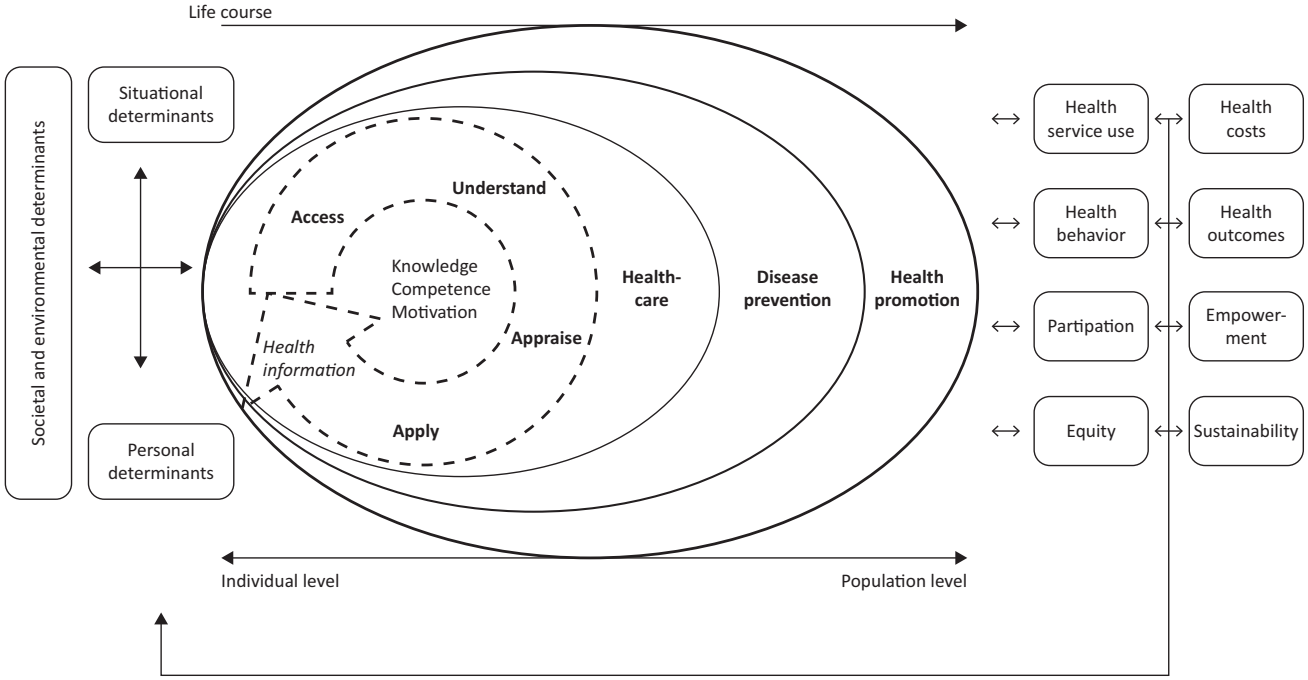

Figure 2. Sørensen et al.'s integrated model of health literacy (2012; with courtesy of Dr. Sørensen).

The KPIs for disease-specific health literacy in the following stage are related to KIPs for digital literacy, as the communities' health knowledge level will only increase as people in the communities are accessing the digital health messages in the community information spots, either with their own smartphones or with the tablet devices in the spots. Knowledge scores for each domain will be calculated individually and at the village level, and comparisons between the groups will be performed. The preliminary results from the first stage indicate that disease-specific health literacy scores, in almost all domains, increases after the participant has been exposed to the digital health messages once. In the follow-ups, during the assessment of knowledge retention, both health knowledge and the actual use of the information spots will be assessed. These results will be valuable in light of digital literacy, as the users will have to manoeuvre single-handedly and digitally in the information spots. No assistants are there to show the animations this time. If the use of information spots increases, for example due to an increase in the number of people accessing and watching the animations or taking the health quiz, we know that people are increasing their digital literacy, basically because they are operating, browsing options and gaining knowledge via a digital device.

In this DigI case study section, we have elaborated upon how a digital literacy program; the DigI project with its information spots, Internet lite and digital health messages, can build health knowledge and health literacy by connecting rural people with digital information. The KPIs established from the on-going study within the project will assist in evaluating the DHI and suggest the revision of both the health content and the user interface. This acquired knowledge can be applied in phase II of the project, scaling up by installing information spots with Internet lite access in more villages. The use of digital health messages is still at a very early stage in rural Africa, but development is happening disproportionately fast. KPIs on knowledge retention will be provided at a later stage by following the two groups over time and monitoring the disease-specific health literacy level in the group that has been exposed to the digital health messages as compared to the one which has not.

This approach has the potential to increase health literacy for a broad group of people and the information spots can provide access to other types of information, thus increasing general, digital, computer and information-specific literacy.

9. Results

In the research and development world, we are facing the three levels of digital divide: the first level in internet access, the second level in digital literacies and competencies, and finally, the third level—the divide in life opportunities and benefits gained from the first two. Obtaining digital skills is a form of human digital capital and is of crucial relevance for life-long learning, opportunities, and improved livelihoods and sustainable development.

Equally important, increasing digital literacy is one of the targets of the SDGs. Its achievement requires a definition and associated measurement to monitor progress. However, as noted by UNESCO (2018), the specific digital literacy competencies and proficiency levels valued by adults depend largely on their specific country and eco-

nomic sector contexts. This view is reflected in the cases studies presented in this article.

Here, we briefly summarise the most significant findings from the case studies. We highlight some results that are relevant to the research questions and the lessons learned.

Through the case study analysis, we have shown KPIs that have been developed for digital literacy in various country contexts, from governmental efforts in India to projects in Kenya, Senegal, Mali, Burkina Faso and Tanzania where experiments were conducted on the use of digital technologies by low-literacy people. All these case studies have in common the lack of digital literacies among the population, especially in the rural areas, thus, the difficulty of bridging level three of the digital divide in improved life opportunities. Further, these case studies belong to similar economic and educational background sets and represent low-income countries. Here, we have explored how various digital initiatives and programmes could contribute to overcoming limitations and increasing capabilities. We have also learned how digital literacy programs can be used to build digital and health literacy, and how KPIs for sustainable development can be established.

In India, it was observed how two digital literacy national programs, participatory and community-oriented skilling designed, integrated and measured the KPI among learners to improve their digital skills in a meaningful way. These literacy programs bridge level 2 and level 3 of digital divide, and they enable first-generation learners to have greater access to education and health, thus improving their lives. KPIs such as user appreciation, the ability of the program trainees to use the digital devices effectively and after the training, analysis of the day-to-day application usage and other qualitative benefits are valuable indicators for the similar programs in low- and middle-income countries.

In Kenya, although the country does not have the developed KPI framework for digital literacy strategy, we've learned from the Tunapanda Institute case how a skills-learning driven community is equipping youth with digital skills necessary for the digital transformation and workforce. The Tunapanda Institute developed a set of KPIs to measure the success of the training program based on life benefits upon the completion of digital literacy, such as the number of graduates in employment and number of graduates joining start-up incubator programs. The study contributes by providing direct and indirect beneficiaries of the tech hub idea, which is implemented via the Tunapanda Institute. It also provides information on the gap between the interest in the idea and the availability of opportunity, indicating that only 10% of the total population of applicants get a chance to undergo the training.

In West Africa, we presented two ethnographic case studies from Senegal and from Burkina-Faso to illustrate how low-literacy users overcome their limitations. Main findings suggest a strong potential of vocal assistance and heavy reliance on voice rather than text to support the use of ICT by low-literacy individuals. The lessons learned from these cases suggest that digital literacy KPIs should include the ability to use vocal communication channels to interact with ICT services.

Finally, in Tanzania, the on-going DigI project and case study presented a set of tentative KPIs that are related to the information uptake and retention after exposure to the digital health messages contributing to the digital literacy and disease-specific health literacy, resulting from the use of the community information spot. The KPIs within the project will assist in evaluating the DHI and suggest the revision of both the health content and the user interface. We learned from this case study that the use of digital health messages is still at a very early stage in rural Africa, however, ICT development is accelerating.

These case studies from various 'under-connected' countries (countries with low or no connectivity at all) indicate the performance of digital literacy training and initiatives that are dependent on socio-economic contexts and user experience. Therefore, developing KPIs around them is a necessity. We have argued that programmes and initiatives for digital literacies should focus on the ability to use both online and offline content.

10. Discussion and Conclusion

The lack of digital literacy is a major obstacle to connecting the 3.6 billion people still cut off from the digital era. We need strong multi-stakeholder collaboration, building internal alliances and partnerships with national and international organisations on digital skills development to extend the benefits of digital technologies and digital transformation. We conclude that for digital literacy to go hand in hand with digital inclusion and social empowerment, it is important that KPIs become an integral part of the digital literacy initiatives and projects. Table 1 presents a summary of the key findings in regard to the KPIs for digital literacy in various country contexts.

Our findings contribute with three new perspectives in the body of literature. First, these case studies are aiming towards understanding the commonalities to achieve digital literacy and set up the KPI framework in various country contexts. Secondly, the literature based on KPIs and digital literacy tends to focus on a particular digital literacy initiative rather than on setting up the KPIs for that initiative. And third, literature based on developing KPIs for digital literacy does not always adopt a grounded approach. In this study, we present who actually needs digital literacy and how those people can be trained to achieve livelihood opportunities with obtained new skills (employment, mobile phone usage, health information access, etc.).

From the presented case studies, it was observed that the lack of basic digital literacy skills is the underlying factor that connects each of these case studies. Another common indicator of these case studies is the

Table 1. Summary of KPIs based on case studies.

Case study country	The main digital literacy KPIs
India	The ability to use digital devices effectively; Analysis of the day-to-day application usage; The ability to use digital devices after training; The user-appreciation indicator.
Kenya	Number of youth trained; Number of trained graduates who were employed; Number of trained graduates who choose other career paths.
West Africa	Ability to change the phone settings of an individual's household members, close relatives or friends Percentage of phone calls successfully placed; Number of an individual's household members, close relatives or friends able to place a phone call; Number of an individual's household members, close relatives or friends able to read, write or send a short text message.
Tanzania (Tentative KPIs)	Disease-specific knowledge retention of the participants, after 3, 6 and 12 months; Accessibility of the health information via community information spots; Ability to use health information in day-to-day life.

knowledge uptake and retention after the obtained digital skills programs, meaning that the low-literacy users will be able to implement their skills in everyday life, at work, in further education. While national digital literacy programs presented in India, and the ICT vocational training centre in Kenya address the users with some literacy capabilities, the presented experiments and projects in West African counties and Tanzania address illiterate and semi-literate population in rural areas primarily, where the digital skills training relies on sonification and voice and video messages. And finally, the digital literacy training in local language holds the importance in these countries due to a largely illiterate and semi-literate user and enabling the material in various formats would address the various levels of literacy. For example, in India, IT training in the local language through Spoken Tutorials has prepared the youth for better employment opportunities. In Tanzania, the case study uses multiple formats (online and offline) in the DHI in Swahili such as video, audio clips and pictures for those illiterates.

Researchers could further contribute and investigate the whole range of 21st century digital skills to define policies for the development of these important skills so policymakers and governments can act upon it. In particular, Research and Development should focus on the determinants of financial digital skills, critical thinking digital skills, collaboration, and communication digital skills that are underreported and underdeveloped. This would further facilitate the precise framing of the KPIs for different variations of digital skills.

We must move forward and update frameworks, policies and programs. However, it may be challenging to have a one-size-fits-all KPIs digital literacy framework. Governments, Ministries and national stakeholders should aim to ensure that the program trainees have better digital skills and learning opportunities for improved life benefits. Policymakers and researchers need to start with the methodology and create an approach that will address local needs and be replicable to other communities.

One of the solutions would be to offer and implement free online services that require the use of the skills we seek here to impart, along with enough help and tutorials to allow users to self-guide. That would address the matter for 75% of cases. These solutions are open-source software that can freely be used to create and deliver open learning resources, contributing to the scaling of digital skills programs and further developing the KPIs digital literacy framework.

Through the open-source software and open learning resources for digital skills, we can minimise costs for replication and customisation and address big groups and communities in the local language, thus, it has potential to reach many people and contribute to the digital transformation in the 'under-connected' areas with low literacy levels helping them to join the information society.

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Conflict of Interests

The authors declare no conflict of interests.

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Article

Do Mobile Phones Help Expand Social Capital? An Empirical Case Study

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Abstract
The rapid adoption of mobile phones, particularly in developing countries, has led a number of researchers to investigate their impact on socioeconomic activity in the developing world. However, until the recent advent of smart communication devices, mobile phones were primarily a relations management technology that enabled people to stay connected with each other. In this article, we focus on this basic function and analyze how people use this technology as a tool to expand their social capital. We use a dataset containing more than three billion call detail records from Rwanda's largest telecommunication operator, covering the whole country during the period from 1 July 2014 to 31 March 2015, and combine these records with data from the fourth Integrated Household Living Conditions Survey conducted by the National Institute of Statistics of Rwanda in 2015. We found that people's calling patterns significantly correlated with the income level of their region, which also dictated the destinations of their calls, with middle-income regions acting as a link between the richest and the poorest regions. From these results, we propose a framework for understanding the role of mobile phones in the development of social capital.

Keywords
call detail records; mobile phones; telecommunications; network analysis; poverty; Rwanda; social capital

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1. Introduction

It has been presumed that mobile phones are a powerful technology that can empower the poor. This makes sense from a purely academic perspective; presumably, those who do not possess a phone can, upon acquiring one, have access to much more information and many more resources. However, some of the limited research on phones and social relations has found that the poor do not make many calls (Galperin & Mariscal, 2007), and while some authors have found a positive relation with social capital (Islam, Habes, & Alam, 2018; Shen & Gong, 2019), others have found no change (Cibangu, Hepworth, & Champion, 2017; Goodman, 2005; Matous, Tsuchiya, & Ozawa, 2011). Having access to new data, namely, call detail records (CDRs), we set out to determine whether mobile phone communication in different economic regions in Rwanda furnished those in impoverished areas with access to people and resources beyond their local communities.

Much research has been done on the impact of mobile phones on economic activity (Abraham, 2006; Amel, 2014; Lee, 2009). However, even though this technology has been found to afford economic empowerment, much less has been written about this technology simply as a relational tool. A phone is a coordination technology whose primary purpose is to connect people; only recently has smartphone use expanded to embrace other functions. It is also the case that even though smartphone penetration has been growing (Silver, 2019; Silver et al., 2019), there are still many developing countries where, although they are available, smartphones are unaffordable. In Rwanda, for example, only 15% of the population possesses one (Collins, 2019).

We decided to focus on the basic functions of this technology, namely calls and text messages (SMS), to explore the calling patterns of people in Rwanda. Our interest in mobile phones as a relational technology emanated from the fact that social relations impact economic factors. The number of relationships one has can limit or expand one's resources; thus, we adopted development theories and the concept of social capital—the connections among individuals that can build trust relations that can give access to resources—to construct the framework for this study.

The dataset used in the study contained more than three billion CDRs from Rwanda's largest telecommunication operator, covering a nine-month period from 1 July 2014 to 31 March 2015. We also used data from the fourth Integrated Household Living Conditions Survey conducted by the National Institute of Statistics Rwanda (NISR, 2015), to map calls to all the districts (administrative regions), grouped by their levels of poverty. These two datasets helped us examine whether or not mobile phones enable people to expand their social capital and access resources by connecting with people outside of their communities.

In the following section, we present a review of the literature, which begins by defining social capital and its benefits, and we address the connections among development, geography, and social capital. The third and fourth sections are dedicated to explaining the methodology and presenting the results. In the fifth section, the analysis is conducted, proposing a framework based on social connections and income. The final section, prior to concluding, offers some policy recommendations.

Our analysis found that mobile phones are a socially reinforcing technology, as the calling patterns of people mimic the types of relationships they appear to have in their face-to-face interactions. While we note that many studies have found that mobile technology has allowed people to grow economically, it appears that the economic gains may be limited by a person's social capital. In other words, technology enables certain activities that may not have been possible before, but we found that there were no dramatic changes in the participants' social capital; instead, there was a limited impact on social connections across populations from different economic strata.

2. Related Work

2.1. Social Capital: Definition and Benefits

The central concept of social capital is that social networks have value. The term has been defined in various ways by many authors; Coleman (1988), for example, defined social capital as a "social structure that facilitates certain actions of actors within such structure." For Narayan (2002), it is a relational concept that encompasses the norms and social relations embedded in the social structures of society that enable people to work together. Lin (1999) defined social capital as interpersonal networks (ties) that can provide access to resources. Emphasizing the relations and interdependence among individuals, Putnam later defined social capital as "connections among individuals, social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000, p. 19). In addition, however, there are related concepts that capture the notion of inclusion and participation in social and political processes, which are often missed in defining social capital. Table 1 summarizes the definitions of these concepts and highlights their common elements. Social capital is thus a factor that affects other aspects of inclusion.

The literature on social capital identifies three types: bonding, bridging, and linking (Lai & Siu, 2006; Putnam, 2000). Bonding capital pertains to close personal relations of the type that normally exists among family members; it is based on strong trust relationships that have forged loyalty among the members. Bridging social capital represents the connections that people have beyond their immediate relationships—these can be acquaintances from the different social circles that people be-

Table 1. Definitions of social capital.

Term	Description	Authors
Social capital	Basic human necessities Freedom of the press Freedom of expression **Freedom to participate in public discussion** **Social justice** "**the importance of taking part in the life of the community**" (Sen, 2000, p. 5)	Sen (2000)
Social opportunity	Access to education, healthcare, social security, and **democratic institutions**	Sen and Dreze (1995)
Social exclusion	**Social structures and political processes** that impact access to power and resources	Gore and Figueiredo (1997)

Note: Common elements of the definitions are in **bold** type.

long to, such as work, school, church, and social groups. Linking capital involves more distant relationships with people, separated not only by their location, but also by different backgrounds and experiences.

Depending on the type of social capital, access to resources differs. Bonding ties, because they involve stronger trust relations, are normally associated with greater access to resources, including information. In this respect, the literature has found a relationship between social capital and informational benefits. For example, Loury (1977) found that black youth are disadvantaged because of a lack of information and experience regarding job opportunities, whereas others might have access to such information from parental connections to the labor market.

Using data from the Chicago labor market, Rees (1966) was perhaps the first to demonstrate the importance of informal channels when looking for a job. These channels, which include referrals from employers and other employees, along with other sources, accounted for about 50% of white-collar hires and more than 80% of blue-collar hires. Other researchers have found that informal networks lead at least to a higher frequency of job offers to applicants (Holzer, 1987, 1988). Similarly, Lin's social resource theory suggests that the frequent use of one's social capital leads to better job outcomes (Lin, 1999).

A social linking network beyond one's local community can also confer economic benefits. As Stiglitz (1998) indicated, complex economic systems are made out of social structures, some of which may need to be changed for development to occur. In the same way that trade expands access to markets, social connections beyond one's local community can expand opportunities for economic activity. They can lead, for example, to an increase in clients, access to suppliers to obtain more favorable prices and benefits, and access to capital. A community able to expand its social capital beyond its geographic area does not have to rely on a single market; it can take advantage of a broader and a more diverse set of needs and economic capabilities. A diverse social network can expand the pool of suppliers and customers for one's products. We find evidence of this in work by Fafchamps and Minten (2001) on the agricultural trade. They found from examining a network of business contacts used by traders that social capital had a significant impact on the traders' output; namely, it increased their factors of production (e.g., greater working capital, manpower, etc.). With survey data from 600 to 800 traders from Madagascar, Malawi, and Benin, Fafchamps and Minten (2001) also found that a trader's business contacts reduced individual transaction costs when conducting trade, providing evidence of the power of social relations. Similarly, a study by Kalnins and Chung (2006) found that among clusters of Gujarati immigrant entrepreneurs in the US lodging industry, group members helped each other to succeed. It is also clear from the literature on disadvantaged communities that close connections facilitate cooperation and the exchange of goods and services among clusters of kin, as documented by Stack's ethnographic research on black families (Stack, 1974). However, these strong ties can also lead to self-segregation, resulting in social exclusion, which can restrict access to resources not available within close social circles.

Our social relationships are crucial because, as individuals aggregate in groups, these groups develop shared identities based on values and beliefs, and the resulting relationships provide access to resources and opportunities (Narayan, 2002). Thus, depending on their composition, different groups have access to different resources. If a group does not have access to many resources, it can compensate for this weakness by accessing resources from other groups.

From a developmental perspective, a problem emerges when portions of a population find themselves socially excluded, meaning that they are unable to participate in the social, economic, cultural, and political life of their country. Social exclusion happens because the ties that bind a group together can exclude those who belong to other social groups with whom they have little in common. Those without access to resources (e.g., jobs, capital, knowledge, etc.) are more likely to be excluded from the economic and political activity of a country (Narayan & Pritchett, 1999); therefore, social exclusion can lead to social deprivation and limited social capital.

2.2. Geography and Social Capital Formation

We tend to believe that social relationships happen in a disorganized manner, but in fact there are easily identified tendencies. For example, for certain groups, the decision about where to live depends on many factors. One, and perhaps the most important, is the cost of living. People with low incomes are naturally going to select more affordable housing (Margo, 1992). Proximity to work is another criterion (Thurston & Yezer, 1994), and whether or not people share similar backgrounds. This latter phenomenon is well known in the economics literature and was best shown by Schelling (2006). We cluster, the author argues, because of our tendency to try to be with people who are like us, a phenomenon known as homophily. However, simple location preferences like these can lead to segregation. Wealthy people tend to live together, as do people from similar ethnic backgrounds. This leads to self-selection effects, which can affect a community's social capital.

In the academic literature, the relationship between social capital and geography is termed the geography of opportunity, which conveys the notion that a person's life outcomes are affected by the place where they live (Rosenbaum, 1995). In certain locations, this can lead to social exclusion, which Atkinson and Hills (1998) define as "exclusion from a particular society, at a particular place and time."

Segregation can increase economic inequality as, invariably, some groups have access to more and better

resources, information, and opportunities. In resource-rich communities, members prosper, while resource-poor locations suffer from deficiencies in all of these areas, which can put residents at a disadvantage, essentially perpetuating and exacerbating their poor economic circumstances.

Up to this point, the literature presented appears to suggest that communities, due to personal preferences (homophily), ends up "de facto segregated," when in fact there are other forces that also result in segregated and disadvantaged communities, namely, government policies. In the US, there are innumerable examples of black families being denied mortgages, refused access to housing subsidies, and forced into segregated neighborhoods on the basis of race (Rothstein, 2017). In Rwanda, the focus of this study, discussions about ethnicity are controversial, given the country's recent history of genocide. There are thus no official statistics on the distribution of tribes or clans. However, there is no doubt that the Tutsis and Hutus have experienced certain territorial privileges at different times in the history of the country (Freedman, Weinstein, & Longman, 2006). For the purpose of this study, the lack of ethnic data and the fact that districts encompass more than one ethnicity, make it unfeasible to discuss social capital formation based on race.

Geographically clustered communities rely on bonding social capital and on strong trust relationships, which can provide both financial and emotional support. The extent to which bonding links can support the community depends on the amount of resources that it commands collectively. If resources are limited, the community can go only so far economically, at which point it has to rely on linking capital. Beyond this set of relationships, the community can gain further access to resources by expanding its network to people it does not know on its own, but through others (bridging capital) who can facilitate the acquisition of resources.

Mobile phones are almost ubiquitous, even in poor countries (Williams, Mayer, & Minges, 2011) however, the mobile revolution does not seem to have yet made enough progress to reduce income disparities (Polèse, 2010). If technology were the solution to our wealth problems, Polèse (2010) reflected, the information revolution would have made economic disparities disappear. In our case, even though the emergence of technologies has made distance less determinant, we wished to know if mobile technologies have enabled people of different economic status to communicate and enhance their social capital and to determine if mobile phones enable people to expand their social capital beyond their geographical communities, from inter-community to extra-community networks (Woolcock, 1998). It should be noted, however, that in the formation of social capital, mobile communication is the medium that allows for people to form ties and norms that bind individuals together. The manner in which this happens—namely, whom individuals choose to socialize with—is what eventually leads to the development of trust relationships and the sharing of the information and resources that are needed to make both economic and political decisions that enhance their welfare. We thus wished to determine if linking capital is being formed across geographically distant communities.

On the basis of the literature, we posed the following hypotheses:

H1: The use of mobile phones will expand people's networks beyond their geographic boundaries.
H2: The richer a geographic community is, the more calls it will make and receive.

2.3. Mobile as a Technology for Social Capital Expansion

The International Telecommunications Union (ITU) estimates that in 2018 there were more mobile phone subscriptions than the total world population, with a penetration of 107% (ITU, 2018). In Africa, this rapid ICT deployment has been considered a communication or mobile revolution that is capable of overcoming infrastructure barriers and supporting the long-term economic development of countries (Williams et al., 2011). The rapid adoption of ICT has thus generated enthusiasm among researchers regarding the expansion of mobile phones among the poor, which promises to support their well-being.

Mobile phones can help reduce the transaction costs associated with time and the monetary costs entailed by meeting acquaintances in person. However, while this technology has the potential to greatly enhance the social, and thus economic, opportunities of the poor, the findings about this relationship are often contradictory. Some studies have found a positive relationship, others a negative one, and yet others a neutral one. In other words, it is unclear whether mobile technologies have been able to replicate existing ties or expand a person's social capital, or whether they might even reduce one's connections with others.

Many have argued that mobile phones are a tool used simply to maintain one's existing social networks (Scott, Garforth, Jain, Mascarenhas, & McKemey, 2005) and that their use is mainly to keep in touch with family and friends (Zainudeen, Samarajiva, & Abeysuriya, 2006). This is evidenced in multiple studies. Elder, Samarajiva, Gillwald, and Galperin (2013) noted, for example, that "mobile phones allow the poor to stay in contact with far-flung relatives they depend on for remittances." Similarly, a study of mobile phone lists of poor people in Jamaica revealed that family and kin were the most called including relatives living abroad (Horst & Miller, 2005). Using observations of mobile conversations in public places, Ling (2008) found that mobile phones allow for the development of stronger ties and the formation of rituals among family and friends who may not be geographically close. Wei and Lo (2006), in a survey of college students, found that strong bonds with family and friends and the need

to express affection were the main reasons for their regular communications, which is to say that bonding social capital had already been established. In this respect, Haythornthwaite (2002) has argued that telephone conversations are more likely to happen when the relations are already strong.

Other scholars have uncovered a positive relation between the use of mobile phones and social capital. Conducting ethnographic work, Katz (2011) concluded that phones help to build social capital. Using semi-structured interviews with refugees in South Africa, Bacishoga, Hooper, and Johnston (2016) found that mobile phones played a positive role in developing bridging social capital and facilitating the users' social and economic integration. A more comprehensive study by Donner (2006) investigated the use of mobile phones by micro-entrepreneurs in Kigali, Rwanda. By analyzing calling patterns, the author investigated how mobile phones expanded the social networks of micro-entrepreneurs. Using a survey, six interviewers visited mobile phone owners in their shops and, taking advantage of their phone logs, asked them questions about each contact in the listings of incoming and outgoing calls and in their SMS feeds. He found that: (1) there was an inverse relationship between the phone owner's level of education and the proportion of business calls; (2) having a landline at home showed a negative correlation with the amount of business calls; (3) the younger the user, the greater the likelihood that their call partner was new to the network; and (4) newer phones registered a lower proportion of business calls, supporting the hypothesis that earlier adopters of mobile phones would have more business calls. Therefore, Donner (2006) showed that mobile phones were being adopted first for business-related purposes; that is, entrepreneurs (micro-entrepreneurs) were purchasing their first phone to expand their business through new contacts.

Other authors have found more neutral or nuanced relations. For example, Eagle, Macy, and Claxton (2010), who used call records for the first time, found that poorer regions in England experienced a higher-than-national-average call volume but had the lowest spatial diversity scores in the country. The prosperous areas had average calling patterns but much more spatially diverse networks than the national average. Rainie and Wellman (2012) and Campbell and Kwak (2011) found that, although mobile phones were positively related to social activity, there was little evidence that they supported the development of "weak ties" in order to bridge relationships.

A study by Yang, Kurnia, and Smith (2011), using mobile logs, found that mobile phones are a useful tool for enhancing a social network. This, however, depends on the type of user. The authors classified users into three categories: (1) passionate users, who are enthusiastic and active and regard their phones as an important tool for their social life; (2) neutral users, who find their phones useful but not critical; and (3) passive users, who use phones for instant communication and tend to receive, more than initiate, calls and messages. As may be expected, the more passionate and active users are, the more they use their phone to organize activities, and they feel comfortable asking for support or help. These passionate users maintain both bonding and linking ties, while more passive users maintain mostly close-bonding relationships. Access to resources, they found, is also related to a person's use patterns.

There are also a few authors who have found a negative relationship between mobile phones and social capital. Galperin and Mariscal (2007) noted, for example, that poor people place few calls. Srivastava's (2005) review of the mobile use literature, for example, argues that mobile phones are contributing to the fragmentation of households, although she does not elaborate on how this happens. She further indicates that, while there has been an increase in spontaneous mobile communication, it appears to be reducing the quality of face-to-face interactions. A longitudinal study of relationships involving self-reported mobile communications with people in Karala, India, found a significant reduction of all types of relations—family, friends, and co-workers (Palackal et al., 2011).

It should be noted that the variability of the findings can be attributed to differences in the methods used to establish the relationship between the use of mobile phones and social capital. Some scholars used surveys and others, observations or call logs. Only one other study used call records to measure economic development. Thus, by connecting data with the geographic locations of calls, this study complements and enhances these previous contributions, determining if and how mobile phones are able to expand the social capital of a community and identifying the types of relations that this technology enables. In particular, we aimed to determine if mobile phones are helping to forge relationships among the different economic regions of Rwanda in ways that support the expansion of social capital.

Based on the literature, this study set out to test the following hypothesis:

> H3: The use of mobile phones will expand people's networks beyond their income bracket.

3. Data and Methods

The main data for our analysis come from Rwanda's largest telecommunication operator and cover the period from 1 July 2014 to 31 March 2015. The dataset contains more than three billion CDRs, which include information on calls and SMS exchanged on the network during that period. We used four attributes for every call or SMS: (1) a timestamp of when the event happened; (2) an anonymized identifier for the event initiator, meaning the person who sent the text message or made the call; two identifiers for (3) the network cell of origin; and (4) the destination. We do not consider other attributes,

such as the receiver, whether an event was a call or a text message, the duration of a call, and so forth.

The dataset captures events that occurred over a network with 3,006 cells mounted on 513 towers. However, we have the location data for only 2,258 cells (see Figure 1). Twenty-four cell numbers were invalid, and 724 were not associated with any single district. Nonetheless, the identifiers reveal that four cells were in the Eastern Province, 664 in Kigali (Rwanda's capital and largest city), 17 in the Northern Province, nine in the Southern Province, and 30 in the Western Province. The highest number of unidentified cells was in the capital city. This might be due to the fact that a number of cells are mounted on building tops, as opposed to towers. Figure 1 shows the locations of the cell towers from which the data were collected.

In addition to the above dataset, we obtained data from the fourth Integrated Household Living Conditions Survey, conducted by the NISR (2015). This survey covered the years 2013 and 2014 and focused on poverty, measured in terms of consumption. Of particular interest to our study were the indices of poverty and extreme poverty for each district. The poverty line in Rwanda was computed in the report by using a food-calorie consumption of 2,500 Kcal per adult equivalent per day, plus expenditures of ≈ 66% of the income designated for food on non-food items. Computed this way, the percentage of people in poverty in various districts of Rwanda ranged from 16.3% to 62.0%, with an average of 39.3%, and the percentage of people in extreme poverty ranged from 5.7% to 39.2%, with an average of 16.2%.

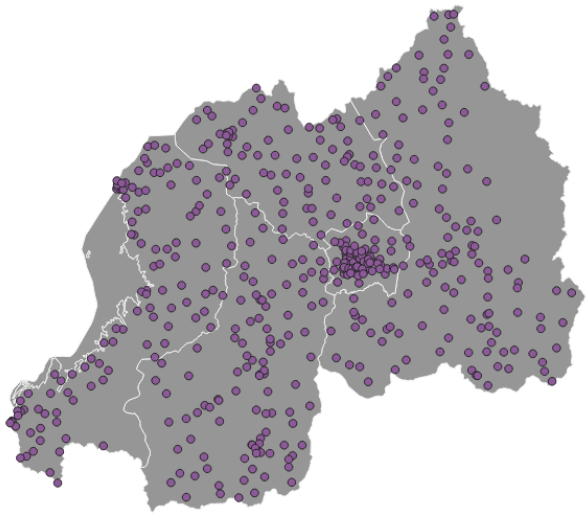

Figure 1. Locations of cell towers. Lines indicate the boundaries of the four provinces and the city of Kigali. Source: Authors.

To understand whether mobile phone communication helped people expand their network (their social capital) beyond the people in their districts, we grouped the districts into four levels of poverty by using standard deviation from the national mean of the percentage of people living in poverty. Table 2 presents a data summary of the districts, grouped by the percentages of people living in poverty. Figure 2 graphically shows the districts based on those groups.

Table 2. District data by poverty category.

Groups by poverty level	Range of people living in poverty	Number of districts	Average district population size
Lowest poverty level	16.3%–28.5%	6	355,134
Low-mid poverty level	28.5%–39.3%	8	353,231
Mid-high poverty level	39.3%–50.2%	11	345,288
Highest poverty level	50.2%–62.0%	5	352,230

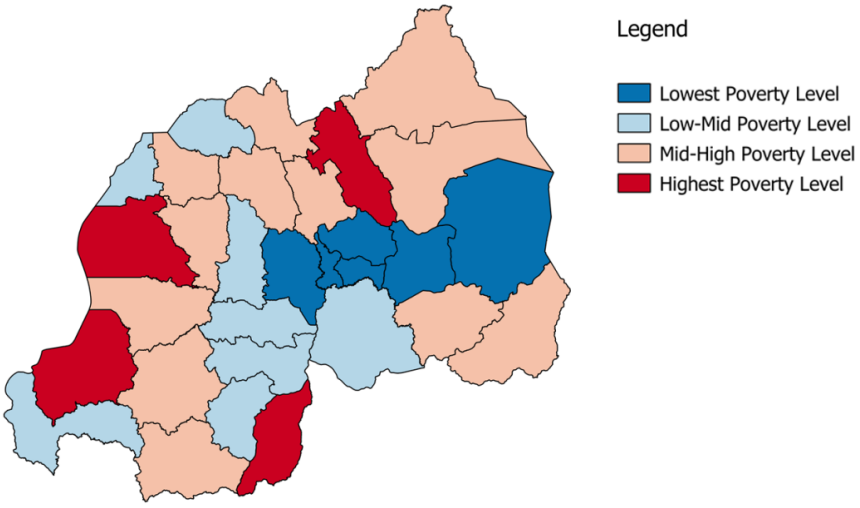

Figure 2. Four levels of poverty in the districts, from the least poor (in blue) to the poorest (in red). Source: Authors.

It should be noted that we did not have detailed data about individuals' income levels; therefore, this study focuses on people who were experiencing poverty as indicated by the district's poverty data, and on whether they were calling people who were a bit less poor.

4. Results

Using the dataset of CDRs, we summed the number of incoming and outgoing calls for each district. Since the districts have different population sizes, we computed the total number of incoming and outgoing calls per capita during the nine months covered by the CDRs dataset, so that we could compare these numbers across districts.

To analyze the relationship between social capital and poverty level and understand whether people expanded their social network beyond their geographical boundaries and income strata, we first compared the number of intra-district calls to that of inter-districts calls. Inter-district calls represented only 3.8% (more than 106 million calls) of the total number of calls, while the rest were intra-district calls (96.2%). This low number of inter-district calls indicates that people mostly used phones to stay in touch with other people in their area and did not expand their social networks beyond their districts. Figure 3 shows the directions of calls in each district category.

Figure 3 indicates that inter-district calls from the least poor districts vastly terminated in other least poor districts. Interestingly, the inhabitants of districts with low-mid-poverty levels mostly interacted with people living in the poorest districts, though the latter are geographically surrounded by districts in the "mid-high poverty level" category (see Figure 2). Therefore, it seemed that geographical proximity had only a limited influence on the volume and direction of calls. To explore the influence of the poverty of an area on the volume and direction of its inhabitants' calls, we calculated correlations and performed linear regressions on the calling patterns observed in the CDRs dataset against the poverty levels of the different districts. Because we were working with a massive dataset, we could not rely on standard statistical packages. Therefore, the regressions used for this analysis were done using Apache Spark, "a fast and general engine for large-scale data processing" (Apache, 2018), as well as MLib, its library for machine learning. We deployed Apache Spark on a local cluster consisting of six servers, totaling 20 processing cores and 200 gigabytes of memory (RAM).

Table 3 shows the correlations between calling patterns, adjusted per capita, and the levels of poverty and extreme poverty in the different districts.

The poverty levels of the districts were strongly negatively correlated with the number of incoming calls per

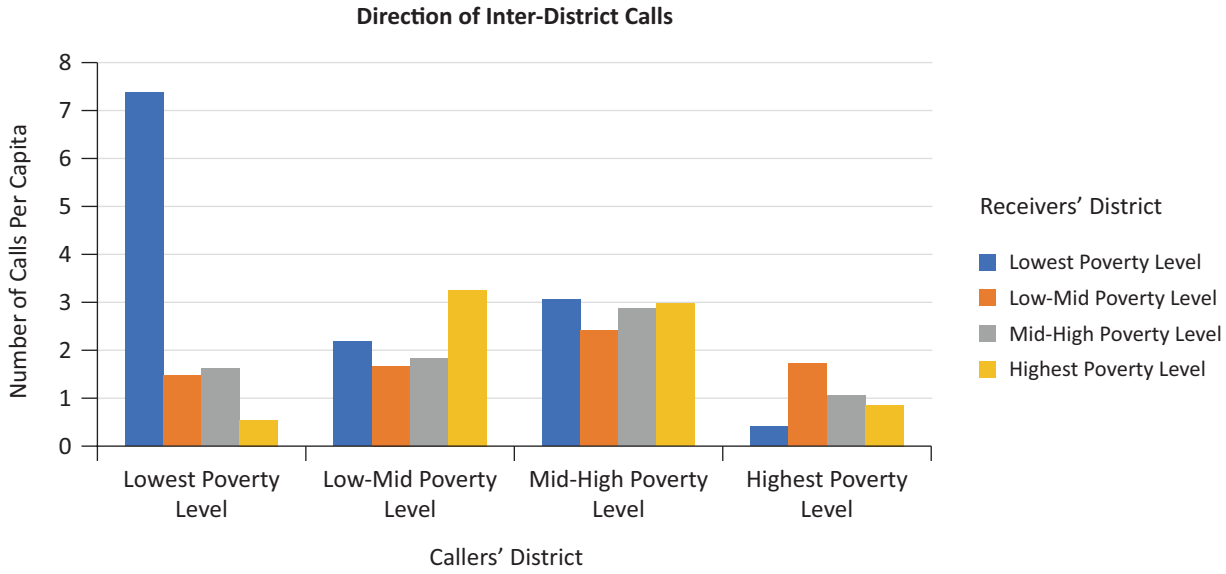

Figure 3. Average number and direction of inter-district calls per capita for each poverty category. Source: Authors.

Table 3. Correlations between poverty levels and calling patterns.

	Incoming calls	Outgoing calls	Poverty	Extreme poverty
Incoming calls	1			
Outgoing calls	0.963*	1		
Poverty	−0.603*	−0.596*	1	
Extreme poverty	−0.419**	−0.468*	0.899*	1

Notes: * p-value ≤ 0.01; ** p-value ≤ 0.05.

capita ($r = -0.603$, $p \leq 0.000$) and the number of outgoing calls per capita ($r = -0.596$, $p \leq 0.001$). However, the levels of extreme poverty were less strongly correlated with the number of incoming calls per capita ($r = -0.419$, $p = 0.02$) and the number of outgoing calls per capita ($r = -0.468$, $p = 0.01$). These correlations suggest that there is a relationship between poverty and the number of calls per capita.

To investigate whether people were reaching out to richer areas when they made calls outside their districts, we conducted a regression on the dataset containing only inter-districts call, with more than 106 million records. The models sought to predict the poverty level of the receiver's district by using the percentages of people living in poverty and extreme poverty in the caller's district, as follows in Equation 1:

$$\text{RP} = \alpha + \beta_1 \text{CP} + \beta_2 \text{CEP}$$

Here, RP is the poverty level of the receiver's district, CP is the poverty level of the caller's district, and CEP is the extreme poverty level of the caller's district. We included both the measures of poverty and extreme poverty since their ratios differ from district to district. Thus, these two measurements have different impacts on the volume and direction of calls. This was an attempt to determine the poverty level of the receiver.

Since we were interested in exploring inter-district calling patterns between districts with different poverty levels, we ran a series of regressions aimed at revealing the relationship between the poverty level of the receiver's district and that of the caller's district, based on the four poverty categories (see Figure 3). Table 4 shows the resulting coefficients.

This series of regressions indicates that, except receivers in districts with the least number of people living in poverty (i.e., the lowest poverty levels), when receivers get calls from another district, it is likely to be from a district with fewer poor people. This can be seen in the negative values of β_1. For example, people living in districts with the highest poverty levels, on average, received calls from people living in areas that had 1.23 times fewer poor people. Interestingly, recipients, particularly those in the middle categories (low-mid and mid-high poverty levels), tended to receive calls from districts with more people living in extreme poverty than their own districts. For example, people living in extreme poverty reached out to people in the middle categories, particularly those in the mid-high poverty level ($\beta_2 = 0.75$). Thus, recipients in the middle-poverty categories (low-mid and mid-high poverty levels) received calls from areas with fewer poor people ($\beta_1 = -0.49$ and $\beta_1 = -0.67$, respectively). The regression models in Table 4 show that people of higher means (category 1) received minimal calls from the extremely poor ($\beta_2 = -0.39$) and more calls from people who were better off ($\beta_1 = 1.25$). This indicates that the least-poor people were calling others of similar economic status. Results further indicate that people in middle categories 2 and 3 were receiving calls not only from people in richer areas, but also from people in extremely poor areas (with 0.54 and 0.75 times more extremely poor people, respectively). In this manner, they acted as a bridge between the lowest and highest poverty-level districts. This can be seen in Figure 3, which shows that people in the middle economic categories had more interactions with people living in areas on the two extreme ends of the poverty spectrum, whereas people in low-poverty districts had minimal interaction with those in areas experiencing the highest poverty levels, and vice-versa.

5. Discussion and Proposed Framework

The results of this study provide some insights into the manner in which mobile phones support a community's ability to build social capital. First, the vast majority (96.2%) of phone calls took place between people living within the same geographic area. This finding suggests that mobile phones do not necessarily expand people's social capital by extending their network across distances. Instead, it appears that mobile phones reinforce existing relationships between people in close geographic spaces. This low number of calls between districts also mirrors the low levels of internal migration in Rwanda, as demonstrated by Blumenstock (2012). The low levels of internal migration would limit the spread of people's social networks to other districts, thereby restricting their social capital as well, particularly when they live in areas with a high degree of poverty. We thus reject H1, where we expected mobile phones to be able to expand people's network beyond their geo-

Table 4. Results of linear regressions (see Equation 1) for each category of receiver poverty level.

	Receiver's district poverty category			
	1	2	3	4
	Lowest poverty level	Low-mid poverty level	Mid-high poverty level	Highest poverty level
Constant (α)	4.42*	50.86*	55.43*	94.46*
Caller's poverty (β_1)	1.25*	−0.49*	−0.67*	−1.23*
Caller's extreme poverty (β_2)	−0.39*	0.54*	0.75*	0.49*

Note: * p-value = 0.000.

graphic boundaries. In fact, we found the opposite to be the case. People are staying within their boundaries, and maybe within their linking networks.

Our results also reveal that the number of incoming and outgoing calls per capita is significantly and inversely correlated with poverty levels, but less so with extreme poverty levels. This would suggest that the use of mobile phones has an impact on people's network of relations, and consequently on their economic lives, only when they already have the basic necessities covered. It could be that people in extreme poverty, who do not have guaranteed access to basic necessities such as food and shelter, are too preoccupied with daily survival and too lacking in resources to plan for the long term, whereas people at the poverty level have their basic necessities covered and, thus, have more time to use their mobile phones to network and access more resources to lift themselves out of poverty. The results thus fail to support H3, where we also expected mobile technologies to enable people to expand their social networks to reach people in higher income brackets. The high number of intra-district calls suggests that people, for the most part, are not talking to people in districts with higher incomes. It should be noted, however, that those who call outside of their districts do call communities in the middle-income brackets, that is, in categories 2 and 3. Thus, this partially supports H2, about expecting the richer geographic communities to receive more calls, since we would have expected the first category (i.e., the least poor areas) to receive the most calls. However, unlike those in other categories, people living in districts with the highest levels of poverty make most of their calls to people in categories 2 and 3. This suggests that the middle poor make greater efforts to expand their social network to potentially get access to resources and enhance their economic well-being, unlike the extreme groups, who mostly communicate amongst themselves.

Nonetheless, a deeper analysis of the direction of calls shows that when people in areas at the extreme ends of the poverty scale (lowest and highest poverty level) call outside their district (inter-district calls), they tend to call people in the middle categories. This suggests that these middle categories play a bridging role between categories 1 and 4.

From the calling patterns we observed, we propose a framework that captures the different roles that mobile communication could play within the different economic strata of the society of a developing country and the patterns of calls we observed. The objective is to tie the literature on social capital to that of development by identifying at a more granular level the impact that technology may have on social capital and the roles that these social relations might play across different income levels. We think that technology is reinforcing existing face-to-face interactions, while recognizing the potential functions that connections with less poor districts might serve. Table 5 presents our proposed classification of the calling patterns that we observed.

Intra-district calls play a potentially different role, depending on the income level. In districts with extreme poverty, their purpose is bonding, which can provide emotional as opposed to economic support, given that residents in these areas have little to offer by way of material resources. The middle districts could provide not only emotional, but also limited economic support, particularly in times of emergency.

Better off communities may not communicate as much outside their group because they may already have what they need or want. They may not have an incentive, at least not an economic one, to contact people outside their group unless it is, we believe, to purchase goods and services that a community of a different income status is providing. For this group, their slightly higher income is significantly correlated more with receiving calls than making them. One could suggest that their in-group communication could be simply for status maintenance.

Given the low number of calls that we see going outside a geographic area, the only group that has a possibility of fostering economic development consists of those with middle levels of poverty, who have more means and economic incentives to take advantage of mobile communication technologies to enhance their resources. This group appears to be more capable of fostering both bridging and linking capital to create greater opportunities for themselves. We suspect that calls made by this group in the middle-income bracket to people in extreme poverty are probably to provide resources instead of to obtain them.

Intra-district calls usually go from the poor to the middle poor, and vice versa. This may be because it is unlikely that a person in extreme poverty would interact with someone with a considerably higher income. Thus, both groups communicate towards the middle. The people in the middle are more likely to communicate with people in the higher bracket (through work, trade, etc.) and people in the lower bracket (e.g., through family links and re-

Table 5. Functional roles of mobile phones by poverty category.

Calling pattern	Income levels		
	Extreme poverty	Middle-level poverty	Lower-level poverty
Inside their district	bonding, social coordination	bonding, economic relief	bonding, status maintenance
Outside their district	linking, support	linking, empowering	linking, social/business enabler

source support) are more likely than people at both extremes are to communicate with each other. For all of the groups, in-group communication—those between people with similar income—is more likely to be of the bonding type, while bridging communication with a higher income group could be to gain access to resources, and in the case of the poor, resources that could guarantee their survival.

6. Conclusion and Policy Implications

Mobile phones are primarily a communication technology, yet previous studies have been inconclusive, given their different focuses and methodologies. This study complements that work by establishing a connection with a caller's and receiver's geographic location and economic status. This study analyzed the calling patterns of a sizable section of the Rwandan population to determine if this technology has helped to expand poor people's social capital and, in turn, their access to resources that could improve their welfare.

Sadly, the vast majority of mobile phone communications took place within the geographic areas where the poor lived, and consequently between people of similar income levels. With the exception of the middle group, most groups did not seem to be developing many bridging or linking ties, which, for the poor, has a negative impact. Given the correlation we discovered between income and social capital, governments could take advantage of this seemingly random set of connections to provide their communities with opportunities for people to expand their connections beyond their natural bonding social capital. In turn, this would effectively create a system that can lead to a more purposeful development of relationships between people from different economic strata.

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Conflict of Interests

The authors declare no conflict of interests.

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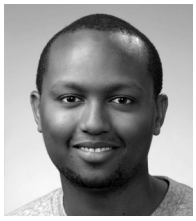

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Article

Implications of Digital Inclusion: Digitalization in Terms of Time Use from a Gender Perspective

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Abstract
The implications of digital technologies for the transformation of gender relations and identities have been discussed since the early days of the internet. Although gender studies have identified clear gender gaps in terms of digital inclusion as well as potentialities for the transformation of women's subjectivity, there is a lack of empirical evidence of the impact of digitalization in terms of time use from a gender perspective. Public policies have begun to address the digital gender gap, but the incorporation of a gender perspective in digital inclusion programmes which promotes women's emancipation by challenging the gender division of time through use of the internet has been not incorporated in the digital policies agenda. This article aims to provide empirical evidence of the mutual interrelation between the time allocation and digital inclusion from a gender perspective. It considers how gender inequalities in time use shape women's experience of digital inclusion and, at the same time, how digital inclusion promotes the reconfiguration of time in women's everyday lives. Qualitative analysis based on episodic interviews explored the representations and practices of internet use by women in their everyday lives. The sample was made up of 32 women who were digitally included through a lifelong learning programme in Spain and had experienced the effects of the Spanish economic crisis. The article argues that digital inclusion does not automatically lead to a more egalitarian allocation of time use for women, but rather places greater value on women's free time.

Keywords
digital gender gap; digital inclusion; gender division of labour; gender inequalities; internet use; time use

Issue
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1. Introduction

Ensuring digital inclusion across the whole population has been a European Union policy priority during the first decade of the twenty-first century, in accordance with the goal of providing all citizens with the skills they need to meet the challenges of the digitalization of the economy and society (European Commission, 2010, 2016). European digital policies have been focused on providing digital skills to e-excluded social groups, which are also the groups with the fewest social opportunities (van Deursen & van Dijk, 2014). Women, and particularly low-skilled women, have been one of the targets of these digital inclusion policies (Arroyo, 2018b; Arroyo & Valenduc, 2016).

These policies assumed that digital inclusion would enable disadvantaged social groups to overcome other social inequalities and be better qualified to meet the demands of a digitalized labour market and society (European Commission, 2010, 2016). Yet there is little empirical evidence to explain how digital inclusion can effectively reduce social and gender inequalities and to what extent. Moreover, the issue of gender inequalities in time use is not considered in studies on the impact of the acquisition of digital skills acquisition programmes.

The reduction of the digital gap brought about by the greater availability of digital technologies across the whole population has opened up debate on whether there is a need to continue developing digital inclusion policies (Arroyo & Valenduc, 2016; Sørensen, Faulkner,

& Rommes, 2011). At the present time, there is a need to provide empirical evidence on which gender and social inequalities are being reproduced and which are being transformed once the first digital gap has been overcome. Public policies have been geared towards addressing the digital gender gap, but the introduction of a gender perspective into digital inclusion programmes—in terms of promoting women's emancipation by challenging the gender division of labour through internet usage—has not been incorporated into the digital policies agenda (Arroyo, 2018b).

This article aims to provide knowledge on how gender inequalities in time use shape women's experience of digital inclusion and, at the same time, how digital inclusion promotes the reconfiguration of time in women's everyday lives, focusing on women who were e-included through lifelong learning programmes in Spain and had experienced the economic crisis. This analysis provides empirical evidence that is useful for the formulation and design of public digital inclusion policies from a gender perspective.

2. Theoretical Framework

2.1. Social Implications of Digital Inclusion from a Gender Perspective

Early insights into the implications of digital technologies for the transformation of gender relations argued that the internet offered a great deal of potential to transform gender relations and identities (Haraway, 1991; Plant, 1998). In terms of time, as they suggest that the internet offers the possibility of adopting roles beyond gender stereotypes, digital inclusion could provide an opportunity to explore new time allocations that challenge the gender division of labour. Despite these theoretical proposals, there is a lack of empirical studies that have determined the potential impact of digital inclusion in terms of gender equality in time use.

Early empirical studies in the field analysed the consequences of being excluded in terms of social inequality by comparing the "haves" and "have-nots," but they assumed that opportunities for internet use are the same across the whole e-included population. This omission was noticed by the second wave of digital divide studies, which detected that access to technology alone does not lead directly to more social opportunities; they demonstrate that a person can be "info-excluded" despite having access to the internet. They went one step further by introducing the acquisition of e-skills and the different types of internet use in their analysis. These studies produced significant knowledge about the different types of use and showed how they are socially stratified (Valenduc, 2010; van Deursen & van Dijk, 2014). From a gender perspective, the second wave of digital divide studies also highlighted how digital skills acquisition and uses of the internet are also gender stratified: Men have more advanced digital skills and use the internet more for leisure purposes than women (Castaño, 2008; Castaño, Martín, & Martínez, 2011; Helsper, 2010).

Having identified the gaps in terms of skills and use, a third level of digital divide studies quantified the impact of these gaps in terms of the unequal distribution of benefits of internet use. Some take into account the variable gender as a socio-demographic characteristic of the sample but did not capture whether digital inclusion challenges gender inequalities such as the gender division of time and labour (Quan-Haase, Martin, & Schreurs, 2016; Scheerder, van Deursen, & van Dijk, 2017; van Deursen & Helsper, 2015).

Studies that address the specific issue of internet time use are mainly concentrated on internet addiction, procrastination, or digital multitasking activities from a psychological perspective (Beavers, Bell, Choudhury, Guyot, & Meier, 2015; Duff, Yoon, Wang, & Anghelcev, 2014; Kim, Hong, Lee, & Hyun, 2017; Müller, Fieseler, Meckel, & Suphan, 2018; Vilhelmson, Thulin, & Elldér, 2016). Their focus is on the impact of mental health issues but not on social factors and the implications of internet use for gender relations.

More comprehensively, studies adopting a mutual shaping approach point out how technologies and society are constantly influencing each other. They explore how digital technologies shape everyday life and, at the same time, how social inequalities and conditions affect the use and production of technologies. From a gender perspective, these studies have made essential contributions on how the use of digital technologies can be transformative or reproductive in terms of gender relations (Sørensen et al., 2011; Wajcman, 2004). In terms of gender division of time and labour, Wajcman (2004) highlights the importance of taking into account the unequal gender allocation of domestic and care work to understand the participation of women in the use and design of digital technologies.

Developing this user experience-focused approach, studies of everyday technology appropriation address the implications of digitalization, taking into consideration the meaning and relevance of the internet in the everyday lives of users (Hafkin & Huyer, 2006; Silverston, 2005; Sørensen et al., 2011). This represents an important advance in that it identifies how users approach digital technologies, considering their own respective experiences. In this respect, the authors argue that people adapt their internet use according to their cultural background and everyday experiences (Simões, 2011; Tyler, 2002).

Despite the conceptual advances made, there remains a lack of empirical research on the mutual shaping of digital inclusion and gender inequalities in terms of time in women's everyday lives. The scant research in this area highlights that gender division of time and labour shapes women's internet experience (Casula, 2011; Simões, 2011).

This study is framed in the everyday technology appropriation approach from a gender perspective, consid-

ering how gender inequalities in time use shape women's experience of digital inclusion and, at the same time, how digital inclusion promotes the reconfiguration of time in women's everyday lives. In order to incorporate more enriched analytical dimensions to address the issue of gender inequalities in time use of the internet, it is necessary to consider the contributions of studies of time from a gender perspective.

2.2. Studies of Time from a Gender Perspective

Studies of time from a gender perspective emerged from the reconceptualization of the "work" approach (Borderías, Carrasco, & Alemany, 1994; Cordoni, 1993; Durán, 2006). This approach reformulated the concept of "work" to include paid employment as well as unpaid care work, introducing time spent on care work into their analysis at the same level as time spent on paid work (Borderías et al., 1994). These studies highlighted the importance and persistence of the gender division of labour, according to which paid, visible work in the labour market has been predominantly masculine, while care work, unpaid and invisible but essential in all societies, has tended to be carried out by women. In terms of time, it involves a gender division of time in which women dedicate more time to unpaid care and domestic labour, while men spend more time working in the labour market.

These studies showed how working hours in the labour market constrict and shape the temporal organization of everyday life, in symbolic as well as material terms (Cordoni, 1993; Moreno, 2007; Torns, Borràs, & Moreno, 2006). This perspective also questions the social pact according to which time is organized in everyday life, such as the agreement on the division of the day into three fractions of eight hours (eight hours to work in the labour market, eight hours to rest and eight hours for leisure). Cordoni (1993) showed that the fraction designated as leisure time for men was time for care work in the case of women. This issue could have implications in terms of the amount of time available for internet use, and the type of digital use, according to gender.

Another consideration of this approach to analysing gender inequalities in time use is the importance of the synchronic perspective of time, which is particularly necessary due to the multiple roles constantly being simultaneously performed by women (i.e., mother/worker/daughter), and which require their simultaneous presence in terms of work (Prieto, 2015; Torns, 2008). To capture the different elements of the synchronic perspective of time and identify the interrelation between the institutional regulation of time, gender norms and the agency of women, these studies considered everyday life the proper context in which to capture these dynamics (Miguélez & Torns, 1998; Prieto, 2015). In accordance with the everyday technology appropriation approach, examination of the dynamics of internet usage in a daily life context will be fruitful in capturing both the dynamics of the allocation of time and the significance and practice of women's use of digital technologies.

With regard to time allocation in the case of women, the most recent findings of these studies identify an important individualization process in women that affects the time structure of their lives. They show that the domestic norm—according to which women perceive their identity as primarily caregivers dedicating the most important times of their lives to care and domestic work—is diminishing (Callejo & Prieto, 2015; Torns, Carrasquer, & Grau, 2015). In contrast, women are now more oriented towards their professional development and spend more time in the labour market. However, this greater participation in the labour market has not been accompanied by a reallocation of care work, thus women suffer the consequences of the "double presence" that consists of assuming both paid work in the labour market and unpaid care work in the home (Carrasquer, 2009; Torns, 2008). The most recent studies also point to women's increasing demands for time for themselves (Torns et al., 2015). Examination of internet practices will provide the proper space in which to identify the role of digital inclusion in the process of women claiming and managing time for themselves.

This desire on the part of women to have more time for themselves has been affected by the economic crisis (Prieto, 2015). Long and irregular working hours, and reduced family purchasing power—which has led to the growth of care and domestic work—have increased "time poverty," particularly for low-skilled workers and women (García, 2017). It is pertinent to explore time issues in relation to digital inclusion at this moment of the crisis to capture whether internet use has played a role in facing the consequences of the crisis.

Considering the insights drawn from studies of time use from a gender perspective, our analysis of views and the significance of the impact of digital inclusion in time use among women in their everyday lives will provide the proper field in which to capture the dynamics of women's decisions on their use of time. It will also capture the role of digital inclusion in the reconfiguration of time use in women's everyday lives and changes in allocation of time (and work) among family members that challenge the gender division of time and labour.

3. Methodology

From a qualitative approach, we analysed the interrelations of time allocation according to use of the internet among women. The results are based on episodic interviews with 32 adult women who had participated in a lifelong learning programme of digital inclusion over the last 10 years in Spain.

The goal of these lifelong learning digital inclusion programmes was to provide basic digital skills to boost social opportunities for e-excluded citizens and disadvantaged social groups. This article does not aim to provide

an evaluation of these programmes; however, the results of our analysis will provide recommendations for the design of digital inclusion public policies which address the issue of gender equality in time use.

The selection of the sample was performed by means of an on-line request to participate in the study; this was disseminated with the help of organizations who have implemented digital inclusion programmes in Spain over the last 10 years. The selected women were adult, working-age women (26–61 years old) who started to use the internet in the last 10 years. The women in the sample have experienced life without being connected to the internet and will therefore be able to identify changes produced in their everyday lives as a result of their digital inclusion.

As shown in Table 1, the participants came from different socio-educational backgrounds and age groups, but there was a higher representation of women over the age of 45 with a medium or low level of education. The participants' ages ranged from 26 to 61 years old, but nearly three quarters of them were 45 years old (12) or older (11). Educational attainment was equally distributed among women with a primary level of education or below (12) and women with a secondary education (12). Only eight of the participants had a higher level of educational attainment.

The characteristics of the sample are particularly relevant because the participants were mainly from disadvantaged social groups with respect to the digital sphere and the labour market. Women from older generations and with a low level of education experience the widest digital gaps (Arroyo & Valenduc, 2016; van Deursen & van Dijk, 2014) as well as the most precarious conditions in the labour market, which has deteriorated due to the economic crisis (Ficapal, Díaz, Sáinz, & Torrens, 2018; Torns & Recio, 2012).

The fieldwork was conducted between February and September 2014 during the period of economic crisis in Spain (García, 2017) and included 17 unemployed women and 15 employed women. This analysis is particularly relevant in the context of the impact of an economic crisis in which there has been a reallocation of time use in the everyday lives of an important part of the population, particularly in countries with higher levels of unemployment such as Spain (Prieto, 2015).

The episodic interviews (Flick, 2000) were structured into three parts. In the first part, interviewees were asked about their "digital biography" in order to discover their internet use trajectory and explore how they used the internet in their everyday lives. The second part consisted of narrower questions focused on the time available to interviewees to connect to the internet. In the third part, we explored the women's views with regard to the reallocation of time use in their everyday lives as related to their digital inclusion. Finally, the interview concluded with a question that asked what internet use recommendations the women would give to a hypothetical, e-excluded friend.

The interviews were coded using ATLAS.ti qualitative data analysis software, adapting the conceptual considerations from the everyday technology appropriation approach from a gender perspective, and the analytical dimensions of the studies of time use from a gender perspective, to the empirical material. To accomplish this, codification was structured into three main codes: time for connecting; time of connecting; and reconfigurations of time in their everyday lives.

4. Results

4.1. Time for Connecting

The "double presence" of women in both the labour market and unpaid care work is a key element that the interviewed women viewed as crucial in terms of time to connect to the internet and develop their digital skills. They stressed that the time available to them to connect to the internet depended on their labour situation and their domestic and family responsibilities, mentioning the scarcity of time available to use on the internet.

4.1.1. Impacts of Time in Labour Market

The employed women saw the time they dedicated to paid work as a limitation in terms of time to connect to the internet. They pointed out that their long working hours and level of tiredness when they arrived home did not allow them to spend time on the internet and put into practice the digital skills they had learned on their lifelong learning digital inclusion programme:

> You don't have the same amount of time….You get home at half past ten exhausted, you get home exhausted. By the time you've had a shower, made din-

Table 1. Distribution of the sample by age group and educational attainment.

	Primary education or below	Secondary education	Higher education	Total by age group
25–29	1	0	0	1
30–44	3	4	1	8
45–54	4	2	6	12
55+	4	6	1	11
Total according to educational attainment	12	12	8	32

> ner and cleared up, it's twelve-thirty at night, you think at twelve-thirty I'm going to get on the computer to look something up? What I want is to get into bed…. (46-year-old employed woman)

Along the same line, women also mention that they have invested more time on the internet when they have had periods without employment. In some cases, periods of unemployment or maternity leave have been crucial to developing their digital skills, enabling them to participate in lifelong learning digital inclusion programmes:

> I started…as a result of getting pregnant with my little girl, my work plan changed and I found myself at home and I said, "This is my opportunity." I started doing courses in office information technology, internet…. (48-year-old unemployed woman)

This scarcity of time available for connecting to the internet linked to dedication to work is related to the central role of working hours in the time allocation of women's everyday lives (Cordoni, 1993; Torns, 2008), together with longer and more irregular working hours as a consequence of the economic crisis (García, 2017).

4.1.2. Impacts of Time for Care Work

Care work linked to family responsibilities is the other key element that women identify as a determinant of the time available to them for connecting to the internet and developing their digital skills. All the women indicated that the time they spent on the internet was determined by their family responsibilities. In concordance with previous studies on the impact of familiar responsibilities on internet use (Casula, 2011; Simões, 2011), our interviewees highlighted the scant amount of time they had to devote to the internet, due to "double presence" and their care responsibilities. Most employed women with family responsibilities say they do not have time.

Employed women usually spend time on the internet in the evenings when they have finished all the domestic and care tasks. Women with young children indicate that they are only available to connect to the internet after completing their care tasks, but this is also the case for women with older children and women who live with other care receivers, such as one woman who looked after her father:

> Yes, I have Facebook, and the truth is I do not use it at all. Because all of this takes time, and I do not have time….My daughter takes up all my time. What, you say, 14 years old and still taking up all your time? Yes, because you have to take her places, then you have to pick her up. (50-year-old employed woman)

Unemployed mothers used the times when their children were at school, watching TV, or playing with the tablet to connect to the internet. Only one woman indicated that she had no problems in terms of time to connect to the internet:

> I still have time for everything. I used to work from morning to night and we still had time to do things, so now even more so….I don't have young kids, that's also true, and it's different when you have grandchildren, you say….Because now grandparents are making a lot of sacrifices to care for their grandchildren. (57-year-old unemployed woman)

With the exception of this one woman, a widow with no family responsibilities, it is important to notice that not only women with young children mention the lack of time to connect to the internet due to family responsibilities. Women with older children or other care receivers are also affected by lack of time due to their care responsibilities.

4.2. Uses of the Internet and Reconfigurations of Time in Everyday Life

4.2.1. Time of Work Related to Labour Market

The interviewees—women that acquired their digital skills through lifelong learning digital inclusion programmes—did not use the internet in their everyday working lives, with the exception of those with post-secondary education or higher education who are clerical workers, business owners, or teachers.

The clerical workers only used the internet in their job to search for specific information, such as details of how to use new software or for making travel arrangements for their bosses. Of the two entrepreneurs who used the internet for work purposes, one—a newsstand owner—only used the internet for concrete management issues; but the other, the owner of a marquetry craft workshop, spent more time on the internet to promote their creations maintaining a blog and social networks. The teachers reported more intensive use of the internet searching for pedagogical resources and viewed the internet as essential for maintaining up-to-date teaching content and relationships with their colleagues.

Among the non-qualified workers, only one immigrant woman, who works as a care worker, used the internet to look for receipts to prepare meals for the care receivers she provides care for:

> Because this July, I worked at a house here, a couple, taking care of a couple. I also prepared food. And sometimes she would say to me, "Tomorrow I want you to make me this meal." And I write it down on a piece of paper and when I get home I look it up on the internet and it helps me. And the next day when I go to the lady I say, "Ah, I know how to make lunch." And she says, "What?" And I say, "We do this, and this, and this." And she says, "Yes, ma'am!" Yes, it does help me,

> yes….That's what I say. The internet helps me a lot, it helps me a lot. (38-year-old unemployed woman)

While use of the internet for performing the main tasks of their jobs was reduced, as many of them were adversely affected by the economic crisis, job search was the main use in relation to the labour market. These women mainly used the internet to search for job offers and send their CVs. In the case of immigrant women, they also used the internet to look for the geolocation of a business when they have to go to a job interview (Arroyo, 2018a).

With regard to the reconfiguration of working time in relation to internet use, the women interviewed did not appreciate significant changes, with the exception of teachers, who indicated that they now had to invest more time in updating teaching materials to adapt their classes to the digitalization of the learning process. Regarding job search, only five women found a job using online job search tools, while the rest of the sample experienced no change in terms of reconfiguration of time in their lives due to internet use.

Although the generalized use of the Internet to find a job was mainly used by the unemployed interviewees, the women mostly defined the time they spent on the internet as time for themselves.

4.2.2. Time for Themselves

The women interviewed said they spend time on the internet when they had some time available for themselves: when they were alone, bored, had some free time, or needed to look for specific information:

> I never find the right moment, when I'm at home I've got no time for messing around….But since I'm alone in the morning, because they're out delivering newspapers for two hours in the morning….And sometimes that is the right moment, because they have had to go out. (59-year-old employed woman)

The internet is an ally of the scarce amount of time the women had available for themselves. Women who previously spent time reading or writing considered that the time they spent connecting to the internet had superseded the time they used to spend connecting with themselves, commenting that the internet offered contents that required less concentration and dedication than reading a book or writing. These easily consumed contents are considered most suitable when they are tired or have little time to dedicate to themselves. The internet is used as a tool to manage the "time poverty" which has been aggravated by the economic crisis (García, 2017):

> Before? For example, when I'd finished clearing everything up, I would sit down, and if I had a story to tell, I would write. I used to read something but [laughs]. I write less because, of course, now the internet now gives me bite-sized chunks of information, you start watching YouTube videos. (35-year-old unemployed woman)

Exploring the significance of internet use allows us to capture the nuanced meanings of "time for themselves" as defined by the women interviewed. It is noteworthy that what they define as "time for themselves" is not the same as leisure time. Some of them use the internet for entertaining purposes, such as chatting with friends, or sharing jokes or beautiful images with their friends, but most of them stress that they mainly use the internet for useful purposes such as searching for specific information related to particular news stories, the geolocation of places, health issues, or information to organize holidays or other family entertainment arrangements.

The women interviewed stressed the distance between themselves and other people with plenty of free time to use the internet. They indicate that they are aware of the risk of addiction and explain that there are people who waste a lot of time playing games or sharing junk and nonsense content. Women who recognized having experienced the sensation of being absorbed when browsing the internet immediately stressed that they had self-control and that their internet activity did not interfere with their fulfilling their responsibilities. This was particularly emphasized among unemployed women:

> We get so caught up in things. Me not so much, but I get on the internet and if I start browsing crafts, the world goes away and that's where I stay. I start to search, and one link leads me to another and okay, click on here and I go here, I go there, I go all over the place, I get totally absorbed in that world and the hours just go by….Sure, it's happened to me, too, but I control it. (40-year-old unemployed woman)

This distance the unemployed women place between their internet behaviour and that of people who waste their time on the internet is related to the findings of previous research, which indicate a very strong link between procrastination on the internet and feelings of guilt (Müller et al., 2018), together with the pressure for unemployed people to not allow themselves leisure time (Prieto, 2015). Moreover, it is related to the responsibilities of women as caregivers and the perceived importance of using their time in useful activities (García, 2017; Torns, 2008).

4.2.3. Time for and Redistribution of Care Work

In terms of time spent on caregiving and domestic work, all the women used the internet in their care tasks: to look for recipes, information and resources for children; communicate with family members and friends linked to take care of them; organize family activities; and manage household affairs.

However, two of the women indicated that they reduced the time they spent in conversation with their fam-

ily members and friends linked to taking care of them. With regard to time for household management, two women also mentioned the time saved as a result of the digitalization of banking services. Both of them appreciated that their use of online bank accounts saved them scarce and precious time by not having to go in person to the bank:

> It is a tool that saves you a lot of time because, if you are working, the time you have to be there in the bank, sometimes for nothing, because it is for nothing, sometimes you're there for three hours waiting for your turn. And now on the internet you do it at home in five minutes. You save yourself from having to say, "Now I have to go to the bank and squander two hours of my time." (45-year-old employed woman)

Regarding the reallocation of work, the women interviewed indicated that they had experienced no change in terms of the reallocation of time for care responsibilities and domestic labour within their families as a result of their digital inclusion. They continued to bear the primary responsibility for caregiving and domestic work in their families (Torns, 2008).

Even though the gender division of labour remained the same, one married woman had started to defend her own time on the internet in a manner that involves negotiation as to who does the domestic work:

> Far from it, I have to say….And sometimes I think, "It's time you organized yourself, isn't it?" And then I say, "Every day I will have my two hours on the computer, come what may, and if the house is dirty, whoever wants it clean can clean it, but I will have my two hours and I will browse the web, do my blog or do something else or look something up." (59-year-old employed woman)

It is noteworthy that digital inclusion does not involve a material reallocation of time in women's lives and among family members. However, it can bring about change in terms of women negotiating time for themselves to connect to the internet, together with self-imposed control of time spent.

5. Conclusion and Policy Implications

Our results show that the time available to women for connecting to the internet and the types of use they make of the internet are shaped by the gender allocation of time. The "double presence" of women in both the labour market and unpaid care work is a key element that the women interviewed saw as crucial in terms of time to connect to the internet and develop their digital skills. It is also important to note that it is not only women with young children who point to a lack of time to connect to the internet due to family responsibilities. Women with older children and women who are responsible for other care receivers, such as older parents, are also affected by lack of time due to their care responsibilities.

Women see their dedication to paid work as a limitation in terms of time to connect to the internet. Many of them use periods of unemployment or maternity leave to invest in the acquisition of digital skills to improve their employment position. Employed women reported that they now had less time, and that they had replaced reading or writing time for themselves with connecting to the internet. Rapid access to less demanding content is seen as a strategy for dealing with the worsened conditions of time linked to the impact of the economic crisis (García, 2017).

The women interviewed, particularly the non-qualified workers, do not associate their internet use with their work in the labour market. Few of them use the internet in their daily working lives. This dissociation between internet use and the labour market in women who acquire digital skills through lifelong learning programmes must be take into account in the reformulation of digital inclusion policies. On the one hand, it is important that digital inclusion programmes include skills and resources that women can apply to their jobs in order to reduce the unequal distribution of the benefits of participating in lifelong learning programmes (Luchinskaya & Dickinson, 2019). On the other, it is important that labour market policies support workplace digitalization and consider the contribution made by all workers, including those in low-skilled positions (Arroyo, 2018b).

Time on the Internet was mainly viewed as time for themselves. But analysis of the nuances of meaning, it showed that, for these women, "time for themselves" on the internet is not the same as "leisure time." Although they associated time on the internet as time for themselves, they stressed that they did not waste time on the internet, rather utilizing it for useful activities, particularly in the case of the unemployed women. This is related to the gender social norm of women as primary caregivers and also to the pressure on unemployed people to not allow themselves leisure time (Müller et al., 2018; Prieto, 2015).

It is noteworthy that digital inclusion does not lead to a material reallocation of time in women's lives and among family members and the gender division of labour remained the same. All the women connect to the internet after they have completed their care and domestic responsibilities and none of them identified any changes in time spent on care tasks, with the exception of one woman who was a widow without any family responsibilities. However, digital inclusion has brought about some changes in terms of women negotiating time for themselves to connect to the internet that suggests a demand for meaningful time of their own, as identified by previous studies (Torns et al., 2015).

In terms of policy recommendations, it is important to note that digital inclusion policies must be accompanied by other social policies. On the one hand, time allocation policies are needed to reorganize the social regula-

tion of times in which working hours allow time for caregiving tasks as well as leisure time and meaningful time for oneself (Cordoni, 1993; Torns et al., 2015). On the other, there is an important need for co-responsibility policies promoting the sharing of care and domestic responsibilities between women and men (Cordoni, 1993; Torns, 2008).

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Conflict of Interests

The author declares no conflict of interests.

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Article

A New Player for Tackling Inequalities? Framing the Social Value and Impact of the Maker Movement

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Abstract
The Maker Movement has raised great expectations towards its potential for tackling social inequalities by mediating technology-related skills to everybody. Are maker spaces new players for social inclusion in digital societies? How can this potential impact be framed? While scientific discourse has so far identified broad value and impact dimensions of the Maker Movement, this article adds empirical insight into the potential for tackling social inequalities. The study is based on 39 interviews with makers and managers of maker initiatives and ten self-reporting surveys filled in by maker initiative managers throughout Europe, which have been analyzed qualitatively. We found four main domains in which makers address social inclusion: First, by mediating skills and competences not only in the field of digital technologies but in the broader sense of empowering people to "make" solutions for encountered problems. Second, we found that makers actively strive to provide democratized access to digital fabrication and the knowledge on how to use them. Third and fourth, we found different ambitions articulated by makers to change society and social practices towards a society providing better opportunities for individuals. As an entry point for further research and actions, we derived a maker typology that reflects the diverse and various types of relationships to be found in the maker community. This typology could be used for exploring further collaborations between social actors and the Maker Movement. We conclude with an outlook on potential trajectories of the Maker Movement and specify which could influence the inclusion of marginalized persons.

Keywords
Maker Movement; maker space; social impact; social inclusion; social inequalities

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1. Introduction

Marginalization that might ultimately lead to exclusion from society has been described as a multidimensional process of "progressive social rupture, detaching groups and individuals from social relations and institutions and preventing them from a full participation in the…normatively prescribed activities by the society in which they live" (Silver, 2007, p. 15). Marginalization takes place in different dimensions such as the educational dimension, the labor dimension, or the social dimension, to name but a few. Processes of exclusion and marginalization are not limited to the aforementioned dimensions but concern the digital life as well. The digital divide indicates a gap between those who have access to the Internet and information and communication technologies and those who do not, resulting ultimately in a "second digital divide" where the latter lag behind in their skills development. Those most affected are already marginalized people who usually lack access to many dif-

ferent kinds of resources (Yu, 2006). Social inclusion aims to overcome marginalization and exclusion by initiating a "process of improving the terms for individuals and groups to take part in society, and…[a] process of improving the ability, opportunity, and dignity of those disadvantaged on the basis of their identity to take part in society" (World Bank, n.d.). Hence, social inclusion acknowledges the underlying structural circumstances which exclude people at risk and postulates that these have to be tackled instead of solely looking at the role of excluded individuals and their active attempt to participate in social life. Thereby, just as marginalization takes place in different social dimensions, inclusion refers to the economic, social, political, and cultural sphere which might be regarded as separate but are highly intertwined (Kronauer, 1996).

The Maker Movement, with its claim of being open and providing democratized access to modern fabrication technologies and to equip citizens with crucial 21st century digital skills, might counteract the processes of exclusion for people at risk and contribute to closing the digital divide. Makers are driven by doing something with their own hands, combining traditional crafting skills and tools with digital fabrication know-how such as 3D printers, laser cutters, etc. and engage in a physical community, in a maker space or so-called FabLab, and further virtual communities where knowledge and experiences are shared. Makers strive to create individualized solutions for issues and problems that they encounter in their day-to-day lives (e.g., Awori & Lee, 2017; Buehler, Hurst, & Hofmann, 2014; Korhonen, Parkka, & van Gils, 2003) such as disability, special needs (Bosse, Krüger, Linke, & Pelka, 2019), and environmental issues (e.g., Kohtala, 2015; Kohtala & Hyysalo, 2015). Thus, maker communities create and capture social value and strive to support inclusion. They build "new forms of local, bottom-up business, social and sustainable models, traversing between non-monetized and monetized accounting frameworks" (Millard et al., 2016, p. 54).

Maker spaces that commit to public opening hours are interesting spaces for empowerment and learning—especially for competences linked to the world of technology. While local spaces clearly address their local target groups' needs, the Maker Movement at large also aims at challenging societal issues. Thus, the aim of this article is to understand the impact of the Maker Movement on inclusion and empowerment and to identify opportunities for people at risk of exclusion.

The research question of this article is: Are there any indications that makers can be interesting players for social inclusion issues?

This article will investigate the social value and potential impact of the Maker Movement from the perspective of makers and managers of maker spaces. To answer the research question, we analyzed 39 interviews with makers (29 maker interviews) and managers of maker initiatives (10 manager interviews) and ten self-reporting surveys filled in by maker initiative managers throughout Europe.

2. Background: Social Impact Potential of Making

Since the impact on the macro level accrues to the wider community, i.e., groups or "society" to which the initiative contributes alongside other initiatives or policies, it can hardly be traced back to single activities (Millard et al., 2016). Instead, we focus on the purpose of the activities pursued in the maker initiatives as well as the outcomes on the micro-level. Outcomes as well as impacts are neither purely beneficial nor harmful and can be perceived differently by different actors in society. Thus, we pay special attention to the individual maker's impact intentions and potential conflicts and use this perspective as a methodological background for our research.

Looking at key publications such as Make magazine might convey the impression of one united movement coming together on the promise of a better world brought about by the emergence of new digital fabrication technology (Nascimento & Pólvora, 2018). Yet, as Nascimento and Pólvora (2018) show, the Maker Movement is actually made up of different initiatives with a diverse set of activities and goals instead of being a homogenous global movement. Taking this as a background, our research is directed at understanding the potential of different makers, or groups or types of makers, for tackling inequalities. Building upon the assumption of a heterogeneous movement allows for looking at nuances in impact aspirations and possible conflicts, rather than searching for signs of what has been promised by early pioneers of the movement. To guide our data collection, we collected potential impact areas of the maker community in the field of social inclusion on the base of a literature review.

From early on, STEAM subjects (Science, Technology, Engineering, Arts, Mathematics) or STEM education has recognized the value of maker education for these subjects by offering hands-on learning activities (Dougherty, 2016; Hwang, 2017; Papavlasopoulou, Giannakos, & Jaccheri, 2016). STE(A)M education is seen as a way to bring children from less privileged backgrounds, as well as women, into more technical occupations. To do so, educators increasingly make use of the pedagogy of making (c.f. Papavlasopoulou et al., 2016; Voigt, Unterfrauner, Aslan, & Hofer, 2019), which focuses on hands-on learning, opening black boxes, developing and realizing one's own ideas, and also the development of entrepreneurial skills. In short: Making is founded on "learning by doing" principles (Papert, 1994).

Thereby, empowerment is addressed in multiple ways, such as: (1) empowerment by the act of creating some tangible objects autonomously; and (2) empowerment through hands-on experience supporting knowledge of technology (Nascimento, 2014). The ultimate outcome of education enabling empowerment is that of inclusion and marginalized people empowered by maker communities. Firstly, they might become part of a maker community and secondly, via the new skills acquired, be included in the digital society, often especially linked to

labor market inclusion. Besides fostering inclusiveness by empowering marginalized groups via targeted workshops and programs, maker spaces can be designed in such a way that allows for the participation of diverse groups (Nascimento, 2014). Finally, the products and services developed in maker communities can address societal challenges directly (Unterfrauner & Voigt, 2017). Of special interest in this regard is the notion of shared value creation (Porter & Kramer, 2011). Hybrid forms of value creation, combining economic and social value, are coined "shared value creation" (Porter & Kramer, 2011). This implies making good products for customers as well as society at large by focusing more on the fulfillment of social needs or addressing societal challenges rather than pure profit maximization.

3. Methodology: Expert Interviews with Makers and Maker Managers and Self-Reporting Survey

Using this background for a methodological design, we decided to draw data directly from makers and maker space managers, building on a critical literature review that was used to pre-define three research pillars: (1) organization and governance; (2) peer and collaborative behaviors; and (3) impact and value creation. In order to have a sample that would allow building a typology that would encompass different strands of the maker culture, we applied a purposeful sampling strategy with pre-defined relevant and differentiating characteristics (Creswell, 2007; Merriam, 2009; Miles & Huberman, 1994). We chose ten maker initiatives in eight European countries. These maker initiatives were selected after a mapping exercise based on the two dimensions, with as diverse a distribution as possible (see Figure 1). The two dimensions were chosen as best representing the diversity of social collective movements, by differentiating between different types and configurations of maker activities, namely (1) the scale and interaction dimension as an indicator for the connectedness between makers and (2) the social innovation dimension (Sestini, 2012). The scale and interaction dimensions range from single to network, i.e., from makers who work on their own to a network of strongly connected maker initiatives with distributed awareness, where glocal solutions are found and shared. On the vertical axis, at one end of the spectrum, single actors operate on a situational awareness level as they tend to be relatively isolated, unconnected, and focused more on a specific or local level and aim to find solutions that they personally and situationally encounter. At the other end of the axis, distributed awareness is created through strongly connected makers who collaboratively work on typically large and extensive areas. These distribute, adapt, and apply solutions that are shared in the maker community on a major scale (Salmon, Stanton, & Jenkins, 2017).

The second dimension, on the horizontal axis, is the social innovation dimension that spans from social demand (tackling single social problems individually) to systemic change (broader societal change; Franz, Hochgerner, & Howaldt, 2012; Grimm, Fox, Baines, & Albertson, 2013). Social innovation is defined as an intentional and successful attempt to modify existing social practices or to enable new ones, which create change on a more or less systemic level (Hochgerner, 2013).

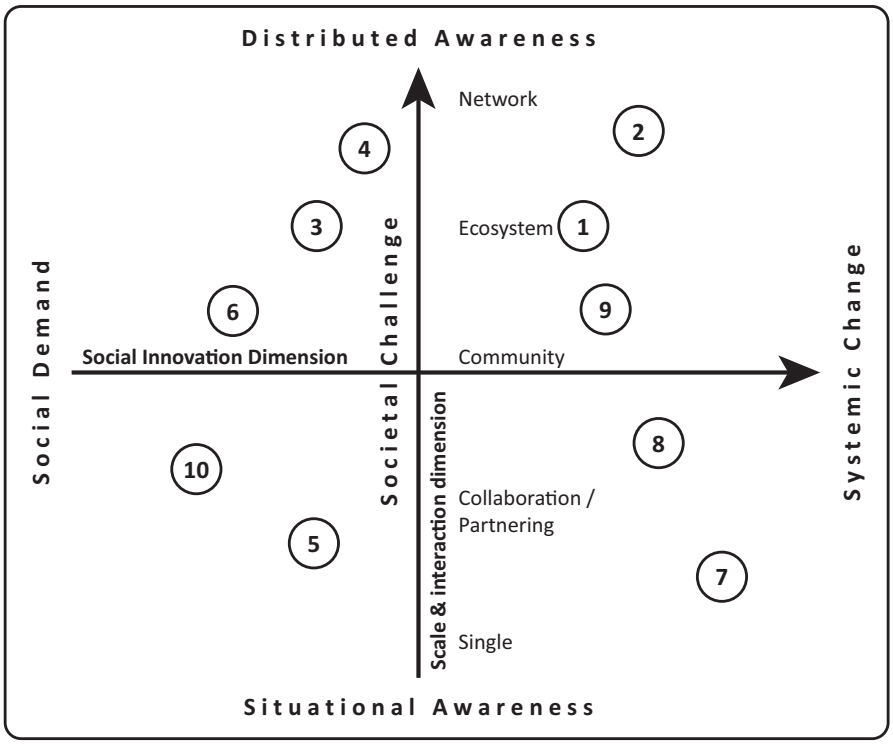

Figure 1. Scale and social innovation dimension (adapted from Millard et al., 2016, p. 63).

Drawing on Murray, Caulier-Grice, and Mulgan (2010) and Bria et al. (2015), it can be described as a continuum of social change outcomes and impacts. At the one end, social innovations respond to social demand on a micro level, i.e., societal and technological innovations are developed that respond to social demands of individuals, sectors, or localities. On the other end, social innovations operate on a macro-level, enabling systemic change, i.e., societal and technological innovations are developed that affect the underlying structures, relationships and powers of society.

The initiatives were information-rich cases that differed in terms of organization and (social) innovation dimension—from a Mini Maker Faire to FabLabs and maker spaces., i.e., DTI lab (DTI, 1), Denmark; FabLab Barcelona (IAAC, 2), Spain; Arduino (3), Italy; Regional Metalworking Network (RMN, 4), the Netherlands; Mini Maker Faire Tartu (AHHAA, 5), Estonia; Happylab Vienna (HLW, 6), Austria; Dezentrale (7), Germany; HRW Lab (HRW, 8), Germany, Create It Real (CIR, 9), Denmark; and FabLab Zagreb (FLZ, 10), Croatia.

We chose explorative expert interviews as a qualitative method of choice (Bogner, Littig, & Menz, 2009) and developed semi-structured interview guidelines (Drever, 2003) for makers and maker initiative managers to be used in a flexible manner while still preserving coverage of similar topics across multiple interviews. In expert interviews, interviewees are considered experts in a specific field; in our case, they were experts on a particular maker initiative as they were managing the initiative or makers in the community of that initiative. The gathered data represents their views and perspectives.

The interview guideline for makers consisted of 19 questions based on the pre-defined three potential impact pillars: eight dealt with making (personal trajectory, kind of activities, development of skills, etc.), four with the maker space they were visiting (kind of engagement activities, etc.) and the remaining six addressed value creation and impact, which is the focus of this article (cf. complete guideline in the supplementary material). The interview guideline for maker initiative managers was structured in a similar way but included questions regarding the organization and peer and collaborative behaviors (cf. complete guideline in the supplementary material). Additionally, the maker initiative managers completed a self-reporting survey consisting of 11 open-ended questions. The transcripts of the interviews, as well as the surveys, were analyzed qualitatively (Mayring, 2010) following a hybrid process of deductive (derived from the research questions) and inductive coding approaches (evolved from the interview data allowing for the unexpected; Flick, 2014). The purposes for also using an inductive approach are for once, supporting to condense raw textual data and to establish clear links between the evaluation or research objectives and the summary findings derived from the raw data. Further, it allows establishing a framework of the underlying structure of experiences or processes that are evident in the raw data (Thomas, 2006). Thus, it enriches the identification of additional themes allowing a direct emergence from the data using an inductive coding process.

This coding process involved the recognition of an important issue and encoding it prior to a process of interpretation (Boyatzis, 1998). Within the process, only codes that would capture a qualitative richness were included and respective themes developed consequently.

4. Findings and Outcomes

The analysis shows that the maker manager and maker perspective complemented each other very well. While managers tended to focus on a strategic level, e.g., shared their mission and vision for the maker initiative and which (social) scope the initiative should address, makers brought in their individual maker experience and shared their personal trajectory and examples of dealing with socially relevant questions in the maker community. Thus, the answers did not contradict each other but rather brought in different layers of observations and thoughts.

In total, 77 codings for social impact of the maker community (the third research pillar—impact and value creation) evolved in the hybrid coding process (inductive and deductive) referring to the four codes: *education*, *inclusion*, *products addressing societal challenges*, and *from consuming to creating*. An additional cluster of codes referring to *clashes in the Maker Movement* evolved as transversal topics in the inductive coding process.

4.1. Education

Education through making was mentioned in the interviews as one of the most important values and impacts. All maker initiatives in our sample were engaged in ongoing collaborations with educational institutions, from kindergartens up to university level. Two of the cases, FLZ and IAAC, were part of the architecture faculty and therefore had many student members. They either offered workshops at their premises or organized events at schools or even lent machines to trained teachers. Typically, the workshops were held under the umbrella of STEAM or STEM education. Maker initiatives provide room for the education of kids and young adults who are usually remote from education and therefore empower them as our interviewees claimed. Furthermore, Maker initiatives have the potential to break barriers and give access to people from different social backgrounds:

> Part of the task which we set ourselves is, of course, to try to break barriers, especially for pupils who would never get the idea to study because they grow up in a social environment where they have no contact at all to universities…social origin determines the educational career a lot here [Germany]. And one of our tasks, which we set out to do, is to provide a bit of

> support there….When I say we were successful here, even though we have no proper measuring tool for it. (Manager, HRW)

The educational ambitions of interviewed makers included educating children, changing the relationship between consumers and producers, and ultimately supporting a mentality shift with respect to consumerism. Maker education has societal relevance as some interviewees said, as it prepares children for the future, not only in terms of 21st-century skills but also in terms of active engagement and critical reflection. Several makers underlined the importance of maker education for society: "I am often asked why I approach schools. It is not for money but because I think it adds value to society in the future." (Manager, FLZ) Additionally, the manager at DTI underlined the educational impact of maker initiatives and its importance for society:

> It is all about providing people with knowledge and tools that make them become more valuable, whatever they do. It is giving them knowledge, practical tools, and approaches that sort of strengthen their capabilities. So education is really important…educating and training people to have a more open collaborative sort of customer-oriented and failure-oriented mindset is very key to us. (Manager, DTI)

According to the interviewees, maker pedagogy would add value to more traditional pedagogical approaches as it offers different learning experiences, but the interviewees reported no evidence of uptake of maker activities in formal education. Further research should investigate this from the viewpoint of formal education institutions, as our research is limited to the perspective of makers.

4.2. Inclusion

All analyzed cases showed a high commitment to the value of openness in the sense that their facilities including machines and knowledge were open to everybody. The maker spaces were accessible for the public, at least at certain hours. Openness is further ensured by signing the FabLab charter for those initiatives that want to be recognized as such. Democratized access to digital fabrication and the knowledge on how to use it would further close digital divides locally around the maker initiative, as the interviewees anticipated. We also found a high interest of many makers towards inclusion and the ambition to make their maker spaces usable to marginalized persons, especially people with disabilities. However, the analysis shows that equal participation of diverse groups is hardly the reality in most cases. Instead, male makers between the ages of 25 and 35 years with a higher educational background and very often with a technological affinity are the most prominent users of maker spaces. One reason could be found in the fact that makers have no experience in working with marginalized persons. Maker initiatives described a different level of awareness regarding inclusion. Noticeably, some tried to engage disadvantaged groups very actively, e.g., by installing a senior design lab, which was meant to attract retired people, with the aim to build on their more traditional crafts skills and combine it with digital fabrication skills. Other examples were mobile pop-up maker spaces that could be brought to disadvantaged neighborhoods. Mobile stations were also brought to refugee camps in yet another initiative not only to empower people but also to develop tools for immediate necessities. Maker initiatives also had an empowering function for unemployed people. The interpretation of the data suggests that the design of the maker space, as well as the educational offers and the facilitators in the maker space, have an impact on the participation of diverse groups. For instance, in maker spaces with female facilitators, the participation of female members was higher.

4.3. Products Addressing Societal Challenges

Many makers showed social ambitions in their doing and developed products addressing specific societal challenges. These resulted either from the engagement of individuals or from organized events such as makerthons in maker spaces. Makerthons, in reference to Hackathons, are events where makers come together with the aim to find solutions for (social) problems. In one maker space, for instance, a makerthon was used to develop a "growing" wheelchair, which could be used from childhood to adulthood by only substituting a few parts and thus making the wheelchair far more economical than conventional ones that have to be replaced completely.

Also, a variety of assistive technologies have been developed in the analyzed cases: a golf tee for persons with a wheelchair, a customized spoon, or a grid to put on the tablet PC that makes it easier to navigate for a person with physical impairments of the hand. Prostheses were also developed:

> I printed two prosthetic covers for a leg and it was a joint operation with me printing and another designing it….The social thing about it was that it was ninety times cheaper than what he would have gotten…[compared to the] traditional way and…to be able to help someone, and still make some money….So I think this is important that you can add more value to whatever you do. (Maker, FLZ)

Maker spaces were used by parents, who sought technical solutions for their children with special needs, and "they can do this by networking with other parents and supporting each other, for example, creating special joysticks that can interact with computers and videogames" (Maker, Arduino).

Other ideas addressed the sustainable production and consumption of food, e.g., vertical gardening projects or hydroponic installations to grow plants with-

out soil in private households. These ideas often dealt with local solutions addressing local problems leading to "new localism" but some might also be taken up globally (glocal solutions).

4.4. From Consuming to Creating

One of the key ways for organizations to create shared value opportunities is by re-conceiving products and markets (Porter & Kramer, 2011). It implies improving products (again) for customers and society at large by stressing more on the fulfillment of basic societal needs.

The Maker Movement and individual maker initiatives enable such a re-conceptualization of products and markets. They transform pure consumers towards a combination of creators and consumers. By creating their own products, makers personalize and adapt things according to their needs while abandoning unnecessary waste and inventory keeping.

Concluding this chapter, overall with respect to the social value and impact dimension, STE(A)M education, maker pedagogy and inclusion were mentioned by the interviewees. Furthermore, in terms of inclusion, it shows a clash between the idea of inclusive maker spaces, which grant access for anybody, and the actual membership data, showing little evidence of members from marginalized groups. On the other hand, we found inspiring initiatives targeted at specific disadvantaged groups.

4.5. The Maker Movement, Seen from a "Clashes" Perspective

Our data reveal conflicts within the Maker Movement on the one side, but also between makers and other actors who are active in the thematic fields addressed by makers—such as education, innovation, inclusion or employment. In the following, we will use these "clashes" as a background for analyzing the potential impact of the Maker Movement for counteracting the processes of exclusion for people at risk and closing the digital divide. In that regard, two clashes that deserve special attention are presented.

While many makers follow "an anti-consumerist attitude" (Devendorf & Rosner, 2015; Unterfrauner, Voigt, Schrammel, & Menichinelli, 2017), we also see makers who align their activities with economic innovation, entrepreneurship, employment, career development, or the production of marketable products or pilots. Our data shed light on contradictory developments, such as maker spaces that run for profit and actively support patent applications and those that urge their users to share all the ideas developed in their spaces with all members. The results of this clash are unclear, but looking at the inclusion of people at risk, paying for a membership and making in a competitive, entrepreneurial environment might foster exclusion instead. Our data also reveal clashes between the Maker Movement and long "existing" institutions, such as schools, enterprises, universities, or civil society actors. Makers report that the culture prevailing in public spaces does not "fit" to that of the Maker Movement manifested in examples such as opening hours, regulations for data processing, or food and drink consumption, the accessibility for "unknown" people or procurement procedures. The multitude of collaborations with different forms of "existing" spaces—like schools, museums or libraries—indicates that the Maker Movement is in a process of liaising with other actors and that the impact potential highly relies on their attitude towards social inclusion.

Figure 2 shows the most salient positive and negative aspects in relation to the social value and impact dimension of the Maker Movement.

5. Synthesis: The "Clashes" Perspective Leading to a "Typology of Makers"

The described clashes with their different attitudes to "openness," "market," or "making" (in the following re-

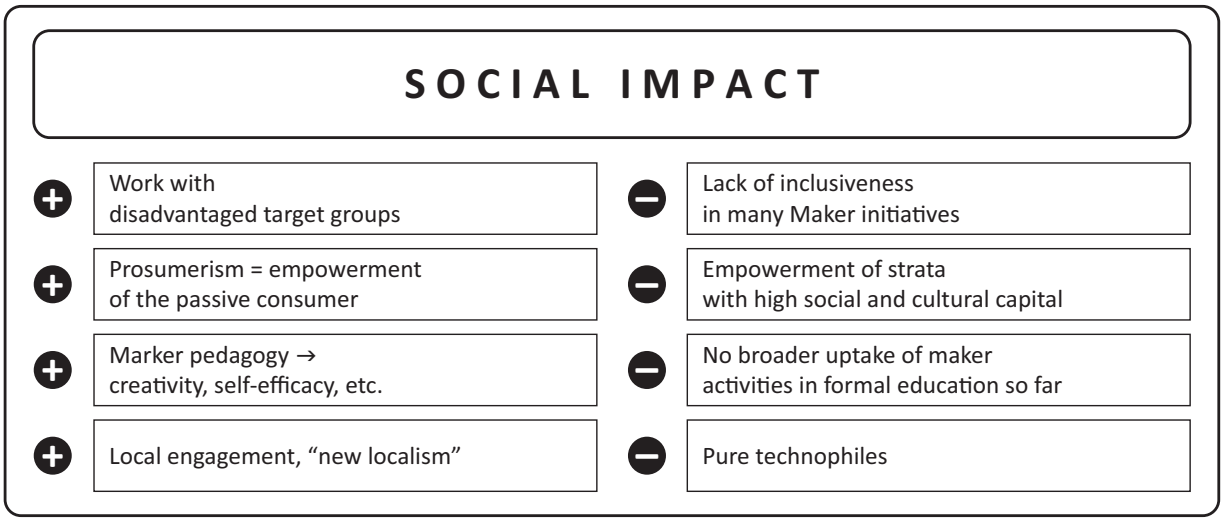

Figure 2. Differentiated perspective on the social impact of the Maker Movement.

ferred to as three "cultural fields") in specific groups of makers could lead to a differentiation of "types" of makers with differentiated sets of attitudes, behaviors, and aims. We suggest an intra-differentiation of the Maker Movement that allows tracing impact in social spheres and therefore contributes to answering our research question. This intra-differentiation follows the three cultural fields, but differentiates depending on the way that a type of maker subscribes to them.

As a first cultural field, the openness of ideas is one of the central pillars of the Maker Movement. This is exemplified by many makers relying on the importance of sharing their work and using the work of others as well as by the broad variety and impact of sharing platforms heavily used by makers. However, makers who try to achieve economic revenues with their activities contest openness. We state that some makers value openness very high but found that makers aiming at financial exploitation of their making seem to value openness less. A second cultural field assembles around attitudes towards marketability of making—examples identified in the case are linked to job creation, career-building, or inventing marketable products or patents. Aside from openness and economic aims, we found a third cultural field: makers who make for the sake of making. We found evidence of makers who pursue different and changing goals of their making and reveal a high fascination with the process of making itself. Makers valuing the attribute "making" as high often also value "openness" as high.

Taking these three cultural fields, which comprise attitudes, activities, and behaviors as a field of differentiation, our cases suggest further differentiating five types of makers at the intersections of these fields (see also Figure 3). We deduced these five types by analyzing the makers' attitudes and assigning them to the cultural fields through a coding process:

1. The first type, "utopian makers," perceives maker values as incompatible with market values or disassociates from market values. Makers of this type value openness very highly and show a fascination for technology and the process of "making";
2. The second type, "pragmatic makers," analyses this ambiguity and recognizes the opportunity to go beyond the traditional dichotomy between openness and market;
3. The third type, "social makers," characterizes makers for whom openness is a key to reduce entry barriers to the market. Many makers of this type identify themselves as part of a community rather than individual makers. Makers of this type often pursue less technical aims and link their activities to education, inclusion, or environmental protection;
4. The fourth type, "making to market makers," gathers cases where proprietary ways are favored to commercialize maker products. Attending maker spaces is often linked to the idea of product or career development and to learning and attending university courses;
5. The fifth type looks at cases where openness is turned into a competitive advantage, as long as it relies on a strong community. As all three cultural fields with their specific behaviors and attitudes are found here, we tend to call this type "mainstream makers."

Taking these five different types of makers as a reference point, an analysis of the Maker Movement's impact on society gains structure; we assume that the development of each type will create different results. "Social makers" are clearly of interest for inclusion activities. If actors in this field can identify makers of this type in their environment, they might be a partner that could add a tech-

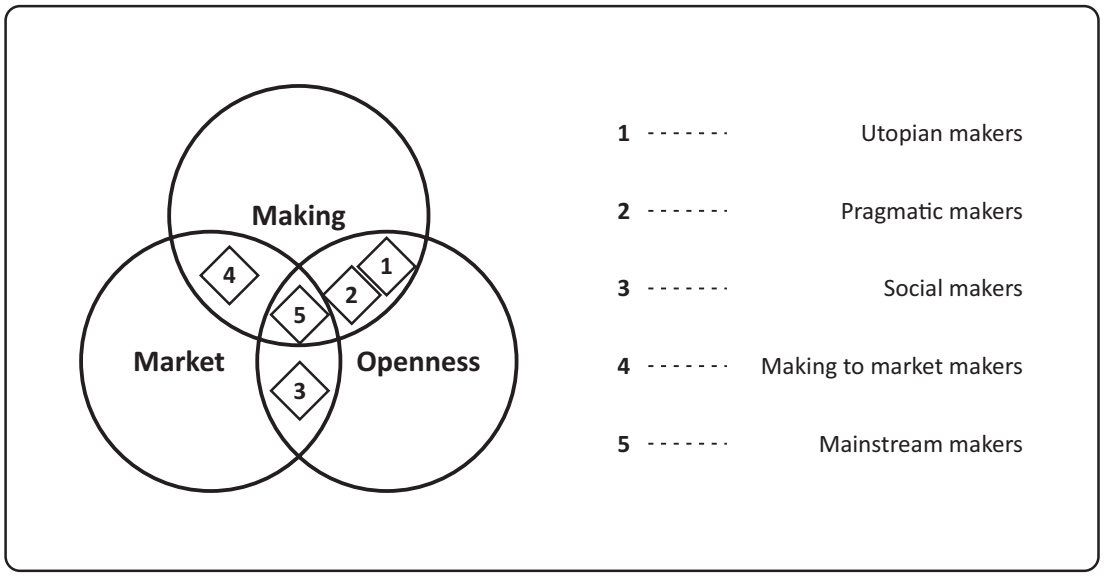

Figure 3. Maker typology.

nological perspective to existing inclusion activities—like addressing the "digital gap." If makers with a strong market orientation expand, we can expect a stronger influence on job creation, innovation in enterprises, and economic change. If "utopian makers" should become more widely spread, an influence on societal values and a shift in mindset can be anticipated. Maker types in relation to "openness" culture could influence the societal perspective on open hard- and software, the sharing paradigm or creative commons—also of interest for educational or inclusion-oriented actors that strive to gain technological competences. "Mainstream makers" seem to be a type that is attracting a large target group without being appalling for makers stemming from other cultural fields.

Our data is a temporary snapshot. Therefore, it does not allow for predictions on the development of those types. However, Langley, Zirngiebl, Sbeih, and Devoldere (2017) suggest that makers could change their attitude and fit into another cultural field and type. The distinction of those five types allows for the prediction of pathways that could be paved and that have an implication on the inclusion of different marginalized groups.

6. Discussion and Outlook

The aim of the article was to explore the perceived values and impact generated by single maker communities on social dimensions. While empirical findings miss exploring associated research questions, this work is an attempt to analyze the view of the makers themselves on the shared value and social impact they create. The qualitative nature of the study, however, also has limitations in many regards. Although generalizations are difficult to make as in any qualitative study, the proposed framework can build the basis for further empirical work.

As outlined by Porter and Kramer (2011), makers create shared value between economic, social, and (often) economical dimensions. However, the study revealed that makers feel a tension between these values. Makers creating shared value act like social enterprises striving for a balance between these often conflicting goals. This sets the background for analyzing the Maker Movement's potential impact on social inclusion, as the different types of makers stand for different impacts on how to tackle inequalities.

The data were analyzed to investigate whether wider social value and impacts are perceived, specifically in the areas of education, empowerment/inclusion, and the products addressing societal challenges. Almost all types of makers show proximity to the education sector—either as part of their own education (at a university, for example) or as a field of practice (e.g., maker spaces in disadvantaged neighborhoods) and could thus offer an educational resource for people at risk of exclusion. Our empirical data confirm the statements from different literature, that under the umbrella of STE(A)M, making embeds well in education: the interdisciplinary approach and its aims as how this pedagogy is put into practice (i.e., learning by doing, fostering creativity, self-efficacy, etc.) is highly aligned with the practice of making. Interviewees see their educational contribution in supporting a mentality shift respectively from consumerism to 'prosumerism' and preparing children for the future. However, in order to reach a broader societal impact, making needs to be introduced into formal education as well as outside school activities to reach different children.

The analysis revealed that despite efforts from the maker communities, equal participation of diverse groups could hardly be reached in most cases. As the study describes, several of the analyzed maker initiatives are targeted to specific societal challenges and finding solutions for social issues. Often these ideas deal with local solutions addressing local problems, leading to a "new localism," but some might also be taken up globally or might be interesting for other disadvantaged people as well (maker types 1, 2, and 5). As for now, the maker communities have not been in the position to attract diverse user groups on a broad basis, despite the fact that their culture is built on openness and many facilities are even free of charge.

Social value and impact seem to be closer to "utopian makers" and "social makers." Consequently, uptake of these types might also increase social value and impact. Makers oriented towards openness and making seem to steer towards educational actors, while makers with ambitions in the market and entrepreneurship seem to strive for collaborations with enterprises. This clash certainly has an influence on the impact the Maker Movement can have on social value creation.

The potential of the Maker Movement for people at risk is manifold in terms of offering access to digital fabrication tools and in terms of sharing knowledge and skills development either in the local maker space or in close collaboration between educational institutions and maker spaces. Our data show that the Maker Movement has high ambitions to be inclusive and, therefore, could be identified as an interesting new player in addressing inequalities. On the other hand, we found little experience in working with marginalized persons, describing makers as open but inexperienced in working with marginalized persons. This could be overcome by collaboration between makers and established actors with roots in tackling inequalities—such as social or educational actors of a formal and informal nature.

Given that the Maker Movement is still a fairly young phenomenon, it comes to no surprise that the highest perceived impact today takes place mainly at a micro level but rarely at a macro level. The future will show if (a growing) Maker Movement can also generate a higher impact in terms of inclusion and empowerment for marginalized groups. We assume that the current picture of the Maker Movement will outlast the period of its growth and differentiation; continuous improvement of quality, a lasting search for partnerships, and on-going clashes with existing actors will characterize the move-

ment in the coming years. The trajectories these developments will follow are strongly bound to the development of the types of makers. If some of these types become stronger and richer in impact; this would steer the direction the overall movement is heading for.

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Conflict of Interests

The authors declare no conflict of interest.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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Article

Fostering Digital Participation for People with Intellectual Disabilities and Their Caregivers: Towards a Guideline for Designing Education Programs

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Abstract
In Germany, libraries or public training centers offer education programs for different target groups to foster digital participation. Yet, those programs often do not meet the requirements of people with intellectual disabilities, their formal caregivers or social institutions. A high degree of personal and organizational effort, lack of caregivers' knowledge and expenditure of time materialize as barriers for caregivers in social institutions to support their clients to achieve digital literacy. However, the desires of people with intellectual disabilities to improve their digital skills have risen steadily in the last years. This article addresses the question of how education programs should be designed to meet the needs of people with intellectual disabilities, their formal caregivers, and social institutions. Therefore, requirements were derived from a secondary analysis of 24 semi-structured interviews with formal caregivers in social organizations, focus groups containing 50 people with intellectual disabilities, and an additional interview study with five experts form research and practice. As a result, a guideline with ten main points for designing education programs for people with disabilities, caregivers and social institutions is presented in this article.

Keywords
formal caregivers; education programs; inclusive education; digital literacy; intellectual disability

Issue
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1. Introduction

We live "in the age of the always-on and always-connected citizen" (Keates, 2019, p. 101). Nowadays, former offline activities increasingly shifted into the online world: online-banking, information research or online-shopping are examples for that (e.g., Bühler & Pelka, 2014). According to Pelka (2017), the process of digitalization encompasses not only technological but also social transformation processes which call for digital skills of both; people who depend on support and institutions that aim to promote the participation of these people. Those who are lacking access or competencies in self-determined internet usage have limited opportunities for participation in accessing knowledge and often have a lower socio-economic status and less social networks (e.g., Dobransky & Hargittai, 2016; Pelka, 2017; Shpigelman, 2018). The ability to understand and to use information from a variety of digital sources has become important in our digitalized society. This ability is called digital literacy and, according to Bawden (2008), comprises competencies like internet searching, hypertext navigation, knowledge assembly, and content evaluation (Bawden, 2008; Koltay, 2011). While the term digital literacy describes concrete competencies of a person, media literacy is an umbrella concept, which describes "the ability to access the media, to understand and to critically evaluate different aspects of the media and media content to create communications in a variety of contexts" (Koltay, 2011, p. 213). This article mainly refers to the term digital literacy, unless otherwise stated, as it is about learning, understanding, and using information from the Internet by people with disabilities.

Chadwick, Wesson, and Fullwood (2013) found that especially older people and people with cognitive, physical, and sensory impairments have difficulties in using the Internet. Financial and economic barriers, lack of governmental, policy or organizational support as well as missing opportunities for training or education can restrict the participation of these groups of people and lead to digital divides (des Power, Power, & Rehling, 2007). Thus, usage of digital media, especially through smartphone devices, is also steadily rising among people with disabilities:

> Smartphones are very popular among them and fit perfectly their requirements. Even if they had not any previous experience with them before, learning how to use them would be advantageous, since these devices will become useful in some moment of their lives. (Gómez, Torrado, & Montoro, 2017, p. 2)

Recent studies indicated that smartphones have opened up many opportunities. For people with hearing impairments the smartphone has become increasingly important because many apps and technical features exist that make everyday life easier for them (e.g., Ismaili & Ibrahimi, 2017). Also, people with visual impairments benefit from numerous apps and assistive technologies, e.g., navigation systems for the smartphone, screen readers, and text-to-speech functions as technologies to assist online activities (e.g., Murata, 2019). Despite these developments in mobile computer technology, people with intellectual disabilities often seem to be excluded from digital opportunities. Chadwick et al. (2013, p. 379) found that people with intellectual disabilities are "least likely to gain access to and receive the full benefits from the Internet." Dobransky and Hargittai (2016) even mentioned a digital disability divide among disabled people. Lack of access, socio-economic barriers or influences by their social environment are reasons for such divides. The next section presents the state of research on Internet use and digital divides by and among people with intellectual disabilities.

1.1. Research on Internet Usage of People with Intellectual Disabilities

Nowadays, digital divides are researched on several levels. One of these divides exists regarding the Internet use and access by people with intellectual disabilities compared to the general population.

75% of Germans are using a smartphone (Initiative D21, 2018, p. 20). In contrast, only 34% of people with intellectual disabilities use a smartphone. Access to and usage of (digital) media depends on age, living situation and the type of impairment (des Power et al., 2007; Dobransky & Hargittai, 2016). Haage and Bosse (2017) found that among people with disabilities, people with intellectual disabilities are those with lowest smartphone utilization rates:

- 55% of people with hearing impairments;
- 46% of people with visual impairments;
- 45% of people with physical impairments;
- 34% of people with learning difficulties and intellectual disabilities report having access to a smartphone.

This is particularly astonishing considering that the smartphone, as a so-called smart product (Lee & Shin, 2017), contains many technical functions and possibilities to facilitate access to the Internet for this group of people (e.g., read aloud function, text reader, autocomplete functions).

Ågren, Kjellberg, and Hemmingson (2019) revealed that Internet usage between young people with and without intellectual disabilities (aged between 13–20 years) differed in a significantly lower proportion in terms of "access to internet-enabled devices and performed activities…than the reference group." The authors noted, however, that some web applications are associated with a high degree of cognitive and linguistic skills that arise as barriers for people with intellectual disabilities. Dobransky and Hargittai (2016) came to similar conclusions. These authors found that people with disabilities use the Internet less often than people without disabilities. As reasons for this, the authors cited missing accessibility but also a lack of digital skills of people with intellectual disabilities. Gómez et al. (2017) analyzed smartphone usage of people with Down Syndrome and found a great interest and usage rate of those people using smartphone devices. The authors pointed out that people with Down Syndrome still lack digital literacy and need support in training their (digital) skills to learn how to use digital devices.

Besides, the social environment of people with intellectual disabilities (i.e., parents, friends, formal caregivers) takes a special role to provide one-to-one support for primary contact and the usage of technology (Chadwick, Quinn, & Fullwood, 2017; Nälsund & Gardelli, 2012). Heitplatz, Bühler, and Hastall (2019) also showed that opportunities for using and trying new technologies depend on the relationship between formal caregivers and individuals with intellectual disabilities. In line with these results, Hoppestad (2013) identified lack of knowledge or training as well as insufficient caregiver support as barriers. Ramsten, Marmstål Hammar, Martin, and Göransson (2017, p. 712) revealed "lack of organizational support and comprehensive strategies for the use of Information and Communication Technologies (ICT) in municipal social care for people with intellectual disability." The authors stated that "comprehensive vision and organizational support" are often lacking in those social contexts (Ramsten et al., 2017). These and other studies (e.g., Chiner, Gómez-Puerta, & Cardona-Moltó, 2017; Löfgren-Mårtenson, Molin, & Sorbring, 2018) found that the environment plays an important role in the use and access to technologies for people with intellectual disabilities.

A widespread prejudice is that people with intellectual disabilities would be incompetent to learn how to use the Internet or new technologies because of their cognitive impairment (Corrigan & Rao, 2012). In contrast, Nälsund and Gardelli (2012) showed that people with intellectual disabilities are able to improve their digital literacy through short interventions with ICT and the help of their caregivers. The authors also pointed out that the attitudes of caregivers towards competences of people with intellectual disabilities are often low (Nälsund & Gardelli, 2012). Such prejudices are common against these group of people and can lead to restrictions of human rights and social discrimination (Chadwick et al., 2013). Li-Tsang, Yeung, Choi, Chan, and Lam (2007) trained persons with mild-to-severe deficits in basic computer skills such as using a mouse. After a 6-month follow-up, most participants in the study maintained "the ability to perform simple operations using the mouse or spacebar, yet could not complete operations involving multiple steps such as web browsing" (Li-Tsang et al., 2007, p. 13). However, the results of these studies indicated that people with intellectual disabilities are also able to learn how to use technology if they are given the opportunities and support to do so. Education with, via and through media is fundamental for belonging and participating in our mediatized society (e.g., Zorn, Schluchter, & Bosse, 2019). To promote digital literacy, resources from all people who are involved in this process are required. This includes financial and time resources, cognitive skills or the recognition that digital training is important (e.g., Pelka, 2017). The ability to use digital devices, accessing the Internet and to perceive education programs is closely linked to the attitudes of the social environment and the organizational support provided by social institutions (e.g., Chadwick et al., 2017; Heitplatz et al., 2019; Ramsten et al., 2017).

1.2. Aim and Research Question

Although some of the presented studies have shown that ICT interventions with people with intellectual disabilities are important for enhancing digital literacy, there is little research on how exactly these interventions should be designed to meet the needs and requirements of social organizations, formal caregivers and people with intellectual disabilities. It is important that professionals understand the connection between inclusion and media education and possess necessary skills to integrate them into their daily work and pass them on to their clients (e.g., Zorn et al., 2019). Opportunities of enhancing digital literacy for people with disabilities are increasingly discussed in special education, media education, and communication sciences. Concerning people with disabilities, these are still new research fields in Germany (Bosse & Pola, 2017). This article contributes to that field of research and aims to develop a guideline as an orientation for the implementation of education programs in social institutions. This guideline is intended to improve education programs to enhance digital literacy for people with intellectual disabilities and their formal caregivers. This study also examines different stakeholder perspectives on how education programs for people with disabilities should be designed to improve digital participation opportunities. The research question is therefore: Which criteria are important for designing education programs to promote digital literacy for people with disabilities?

2. Sample and Methods

To answer the research question, the interview material of an already conducted study in 2018 was analyzed secondarily. Furthermore, five additional interviews with experts from the research field were conducted. The following section describes the methodology and the sample of the study.

Initially, a qualitative study conducted in 2018 with 24 formal caregivers (13 males, 11 females, aged between 26 and 58) in social institutions in Germany (Heitplatz et al., 2019) was secondarily analyzed considering the research question of this study to find out about the views and perspectives of formal caregivers on the role of education programs to enhance digital literacy for people with intellectual disabilities.

During the same period of time, focus groups were conducted featuring people with intellectual disabilities in formal caregivers' institutions. A total number of 50 (23 males, 27 females, aged between 18 and 35) participants with intellectual disabilities took part in eleven focus groups. The focus groups aimed to find out what kind of digital media is used by people with intellectual disabilities, what problems they might face and what further wishes they might have (e.g., support, education). The procedure in evaluation and transcription, as well as the open coding process, are described in Heitplatz et al. (2019).

In the analysis of the interview transcripts, it became clear that even though there are comparatively few offers for people with disabilities in Germany, these do not seem to be known to the formal caregivers in the social institutions. To find out about this gap and to get a multidisciplinary perspective, five additional interviews were conducted in July and August 2019 in a second step with experts from the research field, namely: Dr. Bastian Pelka at the Social Research Centre Dortmund, Central Scientific Institute of TU Dortmund, and Head of the research area "Work and Education in Europe," who provided a scientific and political perspective; Dr. Nadja Zaynel, Head of the PIKSL Laboratory in Düsseldorf, a model for inclusive media education in Germany, and who provided the perspective of a communication scientist; Dr. Christoph Kaletka at the Social Research Centre Dortmund, Central Scientific Institute of TU Dortmund, also member of the management board and who accompanied the conception of the PIKSL laboratories; Junior Professor Ingo Bosse, Head of the Department of Physical-Motor Development at TU Dortmund, and who

provided both practical experience and a scientific perspective to the interviews; and finally Christian Möser, from TMT Bildungsprojekte (Paderborn, Germany) who offered perspective and experience as a media-pedagogy and education consultant for new media.

The interview guideline for the experts contains questions about participants' perceived relevance of digital literacy for people with disabilities. The transcription and evaluation of these interviews followed the same procedure as the interviews of the focus groups and facility managers in Heitplatz et al. (2019).

3. Results

This section presents the results of the interviews with the formal caregivers, the experts and the people with intellectual disabilities. At the end of the section, the most important points are summarized. Section four discusses the results and presents the guideline. All quotations in this text have been translated from German into English.

3.1. Opinions of Formal Caregivers on Media Education for People with Disabilities

First, the results of the interviews with the formal caregivers will be presented. The topics that were most frequently mentioned by the caregivers are listed. These are suitability, mobility as well as lack of knowledge and skills.

3.1.1. Suitability

Adult education centers (*Volkshochschule*) exist in almost every large city in Germany. Here, education on many different topics is usually offered for several weeks and can be attended for a participation fee. Among these courses, more and more educate digital competences. The caregivers emphasize that these courses do not meet the requirements of people with special needs: "I don't know any offers of adult education centers that would be suitable for our clients, for example" (Caregiver 2, interview, 11 January 2018). Those who cannot read often have no opportunity to participate. They also state that people with intellectual disabilities often need more time and explanations in plain language, which is why more intensive hands-on care is necessary for learning success. However, most adult education centers courses are only offered by one course leader who could then no longer take sufficient care of the needs of all course participants:

> However, it is always difficult. Who of the clients can simply attend a course? You have to discuss in advance what is possible for the course constructors and how you could guarantee the supervision for our clients. (Caregiver 1, interview, 10 January 2018)

For most courses, a participation fee is charged and attendees are required to bring their own devices. Since people with disabilities are more likely to experience financial difficulties than people without disabilities (Dobransky & Hargittai, 2006), the participation fee could constitute a barrier for these people.

3.1.2. Mobility

In Germany, the majority of people with intellectual disabilities live in "residential institutions" in which they are cared for 24 hours a day (Dieckmann & Giovis, 2014). They often have to be accompanied by a caregiver when performing activities of daily living. External courses often cannot be attended because there are not enough employees in the institutions to make such things possible:

> But if there is a resident, who is not able to drive to the city center or somewhere else on his or her own I would have to send a staff member along. Very often, this is not possible for me. (Caregiver 3, interview, 12 January 2018)

A further problem seems to be that there are hardly any courses available which offer in-house education. As one caregiver says, there still seems to be a fear of contacting people with disabilities in our society:

> The question is always: Who dares to come in here? So I won't get any courses for the clients. We will have to work something out for ourselves. It is sometimes very deterrent to come in here; the past shows us that. So it will be a challenge to find someone for us. (Caregiver 6, interview, 5 May 2018)

Only one caregiver had experiences with "Get Online Week" (Becker et al., 2019), an education program that teaches digital literacy for marginalized groups in Dortmund (a city in Germany). This offer has been described as beneficial: "We are very grateful that our clients will enhance digital literacy through this project 'Get Online Week.' This gives us the opportunity to continue working on the topic and build on it as employees" (Caregiver 2, interview, 11 January 2018).

Due to a perceived lack of services, some institutions come up with their own education programs. They try to familiarize their clients with the Internet. In one facility, a desktop PC is provided for all clients. This is a shared computer that can be used by everyone. However, according to the caregiver surveyed, the PC is not used very often. Indications why the PC is not being used are provided by the surveys of people with intellectual disabilities (see next section), who emphasize that they want to work and learn with up-to-date devices on current topics that interest them. As with the general population, the use of a desktop PC is decreasing, while mobile devices such as smartphones and tablets are becoming increasingly popular (Initiative D21, 2018), even among people with disabilities (Gómez et al., 2017).

3.1.3. Lack of Knowledge and Skills

Caregivers report that not all employees are familiar with digital media and the Internet. Acceptance is not always particularly high: "So I also believe that acceptance is the biggest problem, the technology will only work if it is accepted" (Caregiver 13, interview, 3 July 2018).

Another caregiver reports that employees often reach their limits if they are not familiar with the latest topics. If a client then has a question about Facebook or Snapchat, not every employee is able to deal with those topics: "Thank God a colleague has a Facebook account, so she can take a look at the problem together with the client and solve it sooner than those who have never been at Facebook before" (Caregiver 12, interview, 6 June, 2018). Also, there seemed to be a lack of ideas on how people with disabilities can benefit from digital media and the Internet:

> So for the majority of people, the Internet and digital media do not play a role in their everyday lives. But especially because many people have been living here for decades and have their age accordingly. We have an average age of over fifty here. And when they were younger, digitalization was not an issue for them or for us. And so I don't think they are as interested as any other person is at a certain age. (Caregiver 1, interview, 10 January 2018)

Caregivers doubt that the acceptance of digital topics by their employees, especially older employees, is often not high enough. Recent offers have to meet the needs of people with disabilities. This includes more time to get to know the contents and alternative ways of learning and accessing study material for people who cannot read and write. Furthermore, the lack of independence and mobility of the clients is an important point mentioned by the caregivers. Courses might be designed as an outreach service or in-house offer for the institutions where people with disabilities live or work. To raise acceptance for digital topics in the institutions, employees must be allowed to try out and test the digital media to make their own experiences and to gain understanding of what can be done with digital media and how their clients can benefit from it.

3.2. Opinions of People with Intellectual Disabilities on Media Education

After presenting the results of the interviews with the formal caregivers, the spotlight is now on the results from the focus groups featuring people with intellectual disabilities.

3.2.1. Desire for Social Support

The frequency of similar statements from the interviews clearly shows that there is a desire for more support concerning the usage of digital media by their caregivers: "I'd like to learn how to set up the phone. My friends don't always have time and my brother lives so far away" (Focus group 3, group discussion, 20 February 2018). Another participant states: "Somebody has to show me how to use a smartphone. Then I would be able to do that. Alone!" (Focus group 1, group discussion, 6 February 2018). They mainly wish support for the set-up of their device. Also, when downloading apps from the Appstore and installing them, the participants express uncertainties. This issue is a narrow and sensitive level between being overprotective and provide too little support for questions and concerns of the participants. It is important for the participants that they are taken seriously in their questions and that someone shows them what they can do with the device and how it works.

3.2.2. Desire for Education Programs

The focus group discussion also included the question of whether participants had ever attended a training or workshop on digital media or the Internet, or whether they would wish to do so. Here only one participant told that he once took part in a course. Four participants from a social institution told that their institution offers opportunities to use a computer room on certain days of the week. They said that they had tried this once, but that it had been too boring for them: "There's a computer room like this. There you can use the computer. But I didn´t know what to do here. It was boring for me" (Focus group 4, group discussion, 14 February 2018).

All other participants said that they had never done anything like this before, but that they would have a great interest in it if the topics were in line with their interests. Here the safe handling of Facebook was mentioned as well as blocking people on WhatsApp or the handling of one's own data on the Internet. Only five participants denied the desire for workshops and offers. They said that they already knew everything that would be of interest to them. When asked whether they knew other functions and possibilities of their device, e.g., navigation with Google Maps, control of their mobile phone via voice control or the reading aloud functionality, the majority of the participants answered with "No." There seemed to be a great interest in these topics, as participants often wanted to know what exactly they could do with those apps or how, for example, they could enter voice commands into their mobile phones. The interest in getting to know such topics seemed to be of high interest for the participants.

The statements of the participants with intellectual disabilities show that there is a great interest in learning and handling digital media, especially concerning the smartphone and the functions and apps. From this, it can be deduced that course formats should in any case deal with such devices. Other devices (e.g., computers or laptops) are considered uninteresting. It can also be seen here that participants seem to feel that their desire to

learn digital skills is often not taken seriously by their social environment or that there is too little support in the topics relevant to them.

3.3. Opinions of Experts on Media Education for People with Disabilities

Finally, the results of the interviews with the experts will be presented. A number of ideas and suggestions were given on how education programs for people with disabilities could be designed.

3.3.1. Space for Communication and Experimentation

First of all, it is important to create space for digital topics:

> We have seen that spaces have a strong pedagogical effect, a strong supportive pedagogical effect. In pedagogy, the role of space is very important. Space is also a social construct where, for example, repression can prevail, support can prevail. But of course, space also has a physical dimension. (Pelka, interview, 21 August 2019)

Therefore, an organization should provide space for discussion, exchange and especially for digital topics. According to Kaletka, this is not always easy: "We try to find out how such spaces can be defined and created where different people discuss with each other on a normative but also constructive level and express their opinions." (Kaletka, interview, 21 August 2019)

Möser also pointed out that there is a lack of spaces and options that make one's own experiences in organizations, and perhaps also find out that digital participation is beneficial for people with disabilities: "There is a chance to simply try things out" (Möser, interview, 11 September 2019).

To "create space" means that time and opportunities must be given in the institution to talk about digital topics, to express one's opinion and not to be condemned for it. This requires pedagogical and methodological knowledge as well as experiences to create such a space. To "create space" also means that there are physical spaces in which digital devices can be tested. It is important to gain pedagogical support, since the use of a smartphone or tablet needs some explanation for people with intellectual disabilities but also for their caregivers.

3.3.2. Inclusive Cooperation

In all of the interviews, the inclusive cooperation between people with and without disabilities was described as a great added value. Working in tandems was mentioned as a concrete example to teach digital literacy but also to learn from each other how to use such devices:

> I asked a colleague with a disability if she would like to work in tandem because I saw that she knows a lot about WhatsApp. Well, she can't read, but she has struggled her way through it and learned it without being frustrated. (Zaynel, interview, 6 August 2019)

Zaynel described the added value in the fact that people with disabilities can pass on their own experiences in learning digital skills to other people particularly well. In the development of offers to teach media skills, a tandem between an employee and a client with a disability can offer a wide range of added value: Both sides can learn from each other at eye level to better understand issues, to enable mutual communication and to deal with digital media.

3.3.3. Up-to-Dateness

According to the results presented in Section 3.1, social institutions make computers or laptops available for their clients, sometimes without appropriate pedagogical support. Hence, clients with disabilities quickly lose interest or do not even take advantage of these offers.

Bosse posed that orientation towards the interests of the participants can also include using programs like Word or Skype or setting up an email address. Because of these diverse interests and topics, it is essential to ask participants about their interests.

It is also important to ask employees about up-to-date topics that have a significant influence on their daily work. This could be topics such as cyberbullying, online shopping or similar. Interestingly, the topics and contents that emerge (e.g., cyberbullying or sexting) are becoming present in social institutions. Möser noted a temporal shift; the topics, which became present in other contexts (e.g., school) already some years ago, also emerge in social organizations:

> The fact is that it is becoming more and more present in the social institutions—I like to compare this with the area of school—that those problems with cyberbullying or playing digital games on the smartphone arose in the last years. This significantly influenced the daily work of the employees. (Möser, interview, 11 September 2019)

It becomes clear that the currently emerging topics and problems in social institutions are not entirely new and have already become present in other contexts a few years ago, which is why diverse materials and media concepts already exist in these areas. These can provide a good basis for the adaptation of materials or the development of own media concepts in social institutions (Section 5).

3.3.4. Flexible Structure

Flexible workshop structures are very important when teaching digital literacy. This means that there should

be a plan for the workshop, which should also be as detailed as possible including a timetable, defined topics and goals. It is important not to stick on your plan at every time:

> There will be flexible situations and moments to which I have to react. It may take me much longer than I thought, or I might give examples that aren't appreciated at all by the participants. Then I need alternatives, photos or symbols. (Zaynel, interview, 6 August 2019)

In practice, modular structures are particularly suitable. The design featuring modules provides the possibility of shifting the order of the topics according to the interest of the participants. Möser describes his approach with modules as follows:

> The first part deals with a few simple but important technical basics. The second module deals with what people use and how they use it. The third module specifically deals with the negative side of digital media, where cyberbullying and sexting are the main topics. Finally, I create a module with secure passwords. (Möser, interview, 11 September 2019)

Bosse also underlines that participants should be allowed to attend the courses voluntarily and self-determined and should have the right to reject offers during the course.

3.3.5. Create Relationships!

Relationships and trust between course instructors, the participants and their assistants should be built up as an important and not to be underestimated success component. Zaynel also describes the following situation:

> We usually ask the participants at the beginning what they would like to do in the course. Many don't even think about what they want to do with their smartphones. (Zaynel, interview, 6 August 2019)

It can be a possibility to first meet the participants, to make a short social gathering, in which it is not primarily about the topics of the workshop, but about the hobbies and ideas of the participants. Bosse described, for example:

> We had gone over to make a social gathering before the course started. It was not really about computer usage. So we already introduced the course once, but we also had coffee and cake. (Bosse interview, August 20, 2019)

A more informal situation makes it possible to get to know each other, which can represent a good basis for the development of the workshop topics. Even if the general conditions do not allow for a longer period, a short phase should include this at the beginning of the course.

3.3.6. Mission Statements of the Institution

Social institutions respond very differently to the digitization of their facilities. Institutions should decide for themselves whether they want to stand up for the promotion of media literacy of their clients and should be aware of what that means in everyday life:

> Then you have to ask yourself as an institution if you are willing to go along with it [digital media] in everyday life. Institutions must be aware that clients can be frustrated and fail. They need to be aware that topics such as abuse can logically be difficult to address. This also happens in the context of school and youth work. (Möser, interview, 11 September 2019)

The team of the institution needs to find a common positive position toward digitization. A concrete approach could be to develop a mission statement on these issues in a working group or to expand the mission statement in line with digital topics. The employees of the institutions must be involved in this process. Without the acceptance of the employees, such a step is often ineffective (see next section). This can build a suitable base for accompanying the clients pedagogically in the use of their devices in everyday life.

3.3.7. Acceptance among Employees

Pelka described the employees in the facilities as an "important set screw" and highlights an issue as follows:

> Many people working in education, social and care support perceive technology as contrariwise to their work. There is a professional ethic that is closely linked to nearness to people, perhaps physical and emotional. Technologies are often regarded as a hindrance there. (Pelka, interview, 21 August 2019)

According to Pelka, employees in these areas need to understand that technologies can help achieve clients' goals. According to Kaletka, it is also essential that employees should be aware of the importance of digital literacy for people with disabilities as a great and central aspect of participation.

Möser also notes that "awareness of the topic's relevance to the target group is lacking" and "a huge amount of will and need to deal with these issues" (Möser, interview, 11 September 2019).

First of all, it is important to catch up with employees' opinions and take them seriously. Secondly, the employees must be sensitized to their important role in the process of competence and media education. Thirdly, there is a need to be qualified in their own competences by training and further education.

3.3.8. Course Design for People with Disabilities

Course formats for people with intellectual disabilities should be based on general educational principles. Möser made the experience that the participants of the courses understand the content very well and emphasizes that it is important to avoid the following considerations: "What content should be left out" or "what are the participants capable of doing?" (Möser, interview, 11 September 2019).

Zaynel emphasizes that the concept of a Universal Design is a good basis for designing inclusive course formats:

> I'm a big fan of Universal Design. So that you use what all people use. I don't use any special systems in the courses as I don't find them so profitable. If I orientate myself on general programs and systems [e.g., smartphones and tablets] the chance of acceptance is greater. (Zaynel, interview, 6 August 2019)

The concept of Universal Design can also be extended to the design of education programs and materials, and is known in this context as Universal Design for Learning (UDL): "The essence of UDL is flexibility and the inclusion of alternatives to adapt to a myriad variations in learner needs, styles, and preferences" (Rose, 2000). Bosse reported having positive experiences with pictures or pictograms as support for communication and course content. The use of such pictures and pictograms, as well as alternative learning formats and learning materials, are a good basis to adapt the learning content to the needs of the participants.

3.3.9. Information and Cooperation

Some of the institutions have little knowledge about offers in their environment (Section 3.1.2, e.g., PIKSL Laboratory, TMT Bildungsprojekte, "Get Online Week"). More public relation must be carried out. Furthermore, it is important that the institutions actively seek information. The establishment of a staff unit or a coordinator in the social organizations could be a way of performing these tasks. The tasks of such a person could include identification of funding opportunities for the acquisition of technical infrastructure.

Today, some offers to promote digital literacy of people with disabilities are available in Germany, but remain still very rare and, above all, only in some regions of the country. Möser told that it as important to network with partners from science and practice to advance the topic further. A coordinating person or a speaker could fulfill such a function in a social organization very well, as already described.

For being "not a drop in the ocean" (Möser, interview, 11 September 2019), education programs should not only be offered when the situation is already escalating, but on a long-term basis. According to Bosse, it would be optimal if workshop topics could be implemented immediately afterward in larger media projects.

4. Discussion

This study examined different stakeholder perspectives towards the design of education programs for people with disabilities. The following interesting results can be noted:

- Formal caregivers were of the opinion that existing course formats are neither designed to meet the requirements of people with intellectual disabilities (e.g., easy language, number of instructors) nor those of social institutions (e.g., personal resources, time concerns). Because formal caregivers are afraid that nobody dares to come into the institutions to train people with disabilities (e.g., fear of contact), only three institutions try to do their own small ICT training sessions with their clients to introduce them to digital topics. However, these are not attended by people with intellectual disabilities. This leads to the second important finding of this study.
- Participants with intellectual disabilities reported that they often lack support when they use or access the Internet or digital media. Thus, their questions are often not answered. If offers exist in their living institutions, they describe them as boring because they do not deal with their devices (i.e., smartphones) or preferred topics (i.e., Facebook, Instagram or WhatsApp). The lack of interest towards existing education offers by people with intellectual disabilities was equated with a general lack of interest by formal caregivers in enhancing digital literacy for this group of people. Contrary, this study illustrated that the participants with intellectual disabilities showed a great interest in enhancing their digital literacy but criticized that previous offers in their living institutions often do not meet their interests.

Here it can be noted that such misunderstandings arise because people with intellectual disabilities seem not to be asked for their opinion or interests. Recent studies found that, in contrast to other types of disability, people with intellectual disabilities in particular are significantly more likely to experience paternalism (McConkey & Smyth, 2003), stigmatization (Chadwick et al., 2013) and underestimations of competencies and skills (Chiner et al., 2017). As a consequence, the perception of rights, and the striving for life goals is often significantly reduced (Corrigan & Rao, 2012). Due to these attributed prejudices, people with intellectual disabilities are often ignored or not asked for their opinion. In this study, it was shown that this is also true for using and accessing the Internet. As a consequence, misunderstandings between formal caregivers and the perceptions of people with in-

tellectual disabilities exist towards the design, content and conduction of education programs.

Furthermore, it must also be noted that the misunderstandings are not only one-sided. Formal caregivers are often not given the opportunity to inform themselves about new technologies or education programs for their clients. Temporal, personal and motivational reasons are mentioned as barriers by formal caregivers in the studied setting. As already mentioned, it requires "financial and time resources, cognitive skills or the recognition that digital processes are important" (Pelka, 2017). The fact that these resources are often lacking in social institutions has already been demonstrated by Ramsten et al. (2017). Interestingly, this study shows that formal caregivers and people with intellectual disabilities mentioned a desire for more support to be able to familiarize with new technologies. However, only three of the 24 caregivers in this sample saw a need for action and created their own short ICT interventions. Thus, the majority of caregivers did not (yet) consider the topic as relevant to take action.

A multi-layered problem is emerging here. First of all, Internet usage and enhancing digital literacy is perceived as an issue that does not yet requires action. On the one hand, there is the problem that some caregivers design ICT interventions for their clients, which are not used by people with intellectual disabilities. On the other hand, formal caregivers themselves often lack digital literacy, as well as didactic and conceptual pedagogical skills to effectively design such education programs. The question of how to meet these different requirements is the central question of this article. To answer it, two perspectives can be adopted: a formal, designing perspective and a content perspective. In this study, the interviewed experts gave some hints on the design of education programs, which were already presented in Section 3.3. In the following, the mentioned aspects are summarized and can serve as a guideline for the design of education programs:

1. Create space for an open exchange on attitudes and topics related to digitization. Provide opportunities to gain personal experience;
2. Reflect on institutional ideals and discuss the place the digitization should take in the facility. Improve the mission statement;
3. Ask employees for their opinion and take fears and wishes seriously to raise acceptance;
4. Inform yourself about digital topics to establish possible cooperation;
5. Work within inclusive groups or tandems on specific topics;
6. Use UDL to derive practical operation criteria for inclusive education programs;
7. Take into account the topics and wishes of the participants;
8. Orientate on modular structures in terms of topic, content and organization;
9. Build relationships to understand the participant's and individual needs;
10. Treat people with disabilities like everyone else.

The points mentioned above can be arranged on the axes of Figure 1 and help to further define the needs, goals and methods of such education programs.

One way to address the complex problem found in this study is to analyze experiences of participants, levels of media literacy and the quality of an education program. Figure 1 can serve as orientation for the persons who design such offers, but it can also be useful for social institutions to find or design the appropriate offer for their institution.

The left side of the figure (y-axis) shows five different levels of service quality described by Pelka (2017). Providing access to the Internet in a social institution might be the first and lowest level of service quality. When formal caregivers and people with intellectual disabilities interact with each other and develop solutions for current topics (e.g., cyber mobbing), this would lead to a higher level of quality. The middle axis shows three contents of media literacy according to Baacke (1999). Here, the aim should be to find out about the current status quo of media literacy, attitudes and needs of course participants and to estimate at what level(s) the education program should take place. For this purpose, it would be useful to conduct a media analysis of potential participants before starting such course. The Personas concept can offer such a possibility (Maier & Thalmann, 2010). The x-axis describes the degree of experience (from limited to numerous). Experiences are one of the most important factors for technology acceptance (Venkatesh & Bala, 2008). Heitplatz et al. (2019) recently described how the experiences of formal caregivers in the use of technology can have a positive or negative impact on the use of people with intellectual disabilities. Thus, the evaluation of past experiences should play an important role in the creation of education programs.

Many of the points mentioned by the expert as well as the results of formal caregivers and people with intellectual disabilities can be analyzed on the basis of these three axes. Starting with the experiences (x-axis), the sample of this study shows that formal caregivers often reach their limits when they have to use technologies (see Section 3.1.3) and therefore the experiences can be estimated between a limited and moderate level. It seems to be similar for interviewed people with intellectual disabilities, as they stated that they have a strong interest in acquiring more competencies (see Section 3.2.2). Thus, an education program for people in this sample could aim to expand the use, i.e., the first level of media literacy, to create acceptance (see Section 3.3.7), and to obtain information about new developments and technologies. Since people with intellectual disabilities and formal caregivers in this study expressed similar wishes, an inclusive education program for both groups of people could be designed. Such an in-

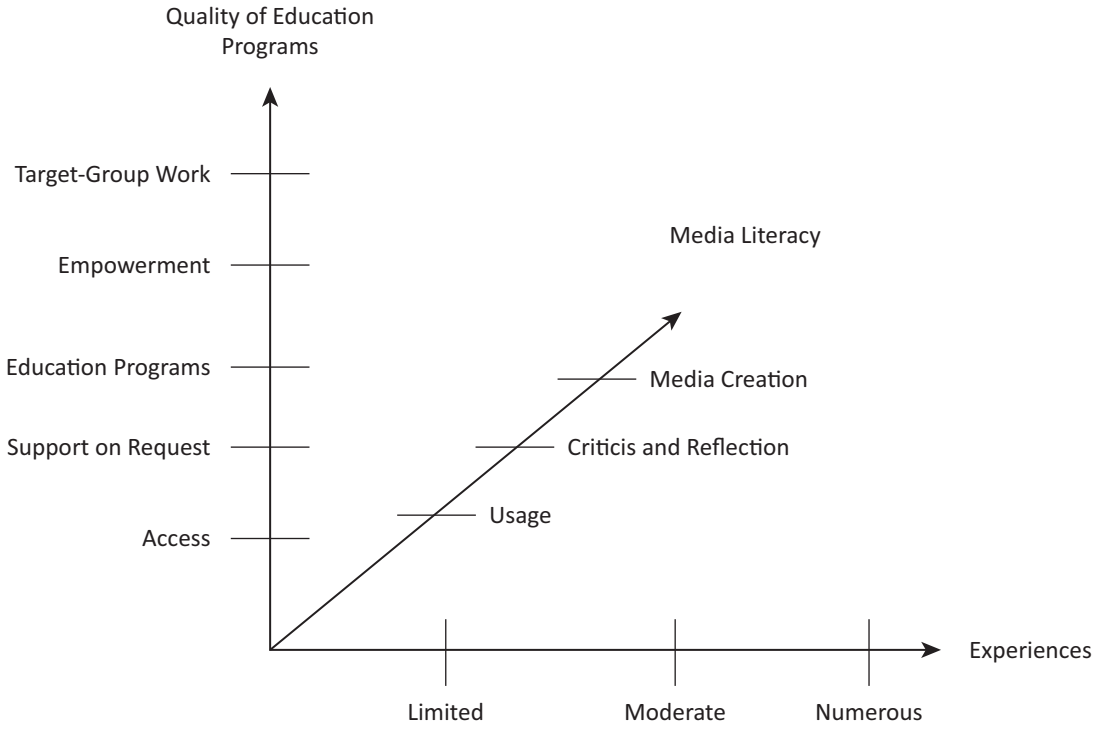

Figure 1. Three levels of analysis for the design of education programs.

clusive cooperation (e.g., working in tandems), as Zaynel (interview, 6 August 2019) stated, provides a high level of quality. Here it is important to take pedagogical and didactic methods into account. A flexible workshop structure with different modules, as described by Möser, or using the UDL as a basic method for designing the content should be considered to meet the different learning needs of the participants.

With the three levels of analysis presented here, the four guiding questions and the advice of the experts, it is possible to develop education programs for very different groups of people or to analyze needs in the institution or company. This analysis does not only consider the formal design of workshops but also encourages reflection on the pedagogical methods, the needs of the participants and the quality of education programs. Hence, designing education programs is not about making special courses for people with disabilities. Rather, it is taking general educational principles and adapting them at one point or another to the intellectual level of the participants. Depending on the group of people and requirements, specific and needs-oriented materials and didactic methods can then be used to implement the education program.

5. Conclusion

People with intellectual disabilities are one of many groups of persons in our society who are often affected by digital divides, face disadvantages in social life (e.g., less social contacts, lower socio-economic status) and have to deal with stigmatizations. Currently, technical aids and smartphone applications have become available for people with hearing or visual impairments (see Section 1). People with intellectual disabilities have so far not been taken into account in research and development of technical solutions. Furthermore, people with intellectual disabilities are often regarded as vulnerable and incompetent and are ignored in their opinions which are also results in this study. Therefore, it is important that this group of people has opportunities to improve their digital literacy to participate in the Internet and to exercise their rights to a self-determined access and usage.

This study indicates that clients of institutions often already use digital media. The decision as to whether or not a social institution wishes to address the issue of digitalization has already been made. Unfortunately, people with intellectual disabilities but also their formal caregivers often lack support and opportunities to enhance their digital literacy. The focus group study showed the willingness of people with intellectual disabilities to learn about the topic. The interviews with the formal caregivers' illustrated a lack of awareness that digital topics are becoming more and more important for people with intellectual disabilities. All the institutions surveyed lack a structured and overarching media concept. As discussed in Section 5, these are criteria for designing workshops (e.g., flexible structure, social gathering) and organizational criteria as precondition for having such education offers. In Germany, awareness of such issues in social work and in working with people with disabilities has only just begun to rise. The topic needs to be developed over the next years. This article provides some first ideas for the design of education programs for peo-

ple with disabilities. The guideline is designed to better understand and address the needs of institutions, caregivers and people with disabilities in the implementation of education programs.

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Conflict of Interests

The author declares no conflict of interests.

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About the Author

Vanessa Heitplatz is a PhD Candidate at TU Dortmund, Germany. Her research focus is on the usage of digital media—especially smartphones—by people with intellectual disabilities. In her doctoral thesis, she investigates opinions of facility managers, formal caregivers, and people with intellectual disabilities within a mixed-methods research design. The research design includes semi-structured interviews with facility managers of social institutions, questionnaires with staff members in those institutions and focus groups with people with intellectual disabilities.

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Article

Effective Experiences: A Social Cognitive Analysis of Young Students' Technology Self-Efficacy and STEM Attitudes

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Abstract
The development of computer skills, as well as computer self-efficacy, has increased in importance along with the role of technology in everyday life. Childhood is a critical time for the development of these skills since early inequalities may substantially impact future life outcomes. In a context of a computing intervention designed to improve digital inclusion, we hypothesize that students' enactive learning experience (conceptualized as their computer usage) and their vicarious learning experience (conceptualized as their perception of their teacher's computer usage) are associated with the development of perceived technology efficacy and STEM (Science, Technology, Education, and Math) attitudes. Data are from a sample of elementary school students from an urban school district in the Southeastern United States. The results show that both their direct experiences and their perception of their teacher's computer usage have strong impacts on students' technology efficacy and STEM attitudes, and the former is the stronger predictor of the outcomes examined. The findings suggest that programs aiming to improve digital inclusion should emphasize students' direct learning experience, which would later improve their attitude toward STEM fields.

Keywords
digital inclusion; enactive experience; learning; perception of teachers; STEM attitudes; students; technology efficacy; vicarious experience

Issue
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1. Introduction

The demands placed upon "digital natives" (Prensky, 2001) will continue to evolve as our society shifts from an advanced industrial-based economy towards an information-based economy. The children of today will move into a workplace and become part of a workforce that is very different from their grandparents. The digital generation of children will need a host of computer, information processing, and critical thinking skills in order to be successful in this information age. Unfortunately, some children are not receiving these increasingly important digital skills and abilities even when they have access to computers and the Internet.

Previous research has focused on a multitude of digital inequalities involving those that have access and experience with information and communication technologies (ICTs) and those who do not (Araque et al., 2013; DiMaggio, Hargittai, Celeste, & Shafer, 2004; Robinson et al., 2015). The differential impact of the digital divide remains (Hassani, 2006; Vandoninck & Roe, 2008) despite progress to close the gap for certain groups (e.g.,

women; van Dijk & Hacker, 2003). Specifically, access to ICTs (i.e., digital divide) is important because it can lead to other disparities in users' ICT related knowledge, skills, and willingness to use ICTs (i.e., digital inequality). Consequently, the impact of digital inequality and the need for digital inclusion cannot be understated as the world becomes increasingly digitalized. Digital inclusion is necessary because unequal access to information impacts children's ability to succeed in school and, in turn, their access to quality higher education which subsequently determines the returns on their financial investment of education (DiMaggio et al., 2004). Furthermore, a lack of digital inclusion can negatively affect students' job search self-efficacy (Fieseler, Meckel, & Muller, 2014) and college prospects, which may lead to investment in a lower quality college degree with reduced financial returns (Melguizo & Wolniak, 2012). Further still, information access disparities may have broader health-related impacts on children and adults by limiting their access to digital health services (Robinson et al., 2015). Therefore, we must seek new means and methods to increase disadvantaged children's digital inclusion because a lack of ICT skills and experiences can have far-reaching consequences for children's lives and potentially for society as a whole (DiMaggio et al., 2004; Ritzhaupt & Hohlfeld, 2018).

Digital inclusion has also been linked to a broader range of outcomes connected to life trajectories (Robinson et al., 2015). Recent national initiatives seek to increase minority presence in Science, Technology, Education, and Math (STEM) careers and fields for two reasons (National Science Foundation, 2011). First, increasing minority presence in STEM is needed in order to alleviate economic inequality, as racial/ethnic minorities in STEM careers earn between 26 to nearly 40% more income compared to those who are in social science fields (Melguizo & Wolniak, 2012). Furthermore, Increasing ICT experiences may strengthen minority students' interest in potentially lucrative STEM-based careers. Tapping into the "hidden workforce" of minorities increases the potential standing of minority students as well as our nation as a whole (Frehill, Di Fabio, & Hill, 2008). Therefore, we examine the potential influence of digital inclusion on minority students' interest in STEM fields.

This study adds to our understanding of digital inclusion by investigating several factors that potentially improve digital inclusion and subsequently bolster minority students' interest in STEM careers. Social cognitive theory provides the theoretical framework of this study by contributing to the conceptual cornerstone of self-efficacy (Bandura, 1994). In short, self-efficacy is an individual's belief in their ability to perform a task and achieve a desired outcome. Social cognitive theory posits that enactive experiences and vicarious experiences influence self-efficacy. When a person performs a task the enactive experience either increases or decreases self-efficacy through success or failure. Vicarious experience is the observation of another person performing a task. We examined if students' ICT usage (enactive experiences) and students' perceptions of their teachers' ICT usage (vicarious experiences) improve digital inclusion by impacting young, predominantly minority, urban students' technology self-efficacy and STEM attitudes.

We begin with a traditional literature review (i.e., narrative review) of some the relevant studies surrounding the digital divide as an evolving and persistent social problem. Next, we provide an in-depth overview of the key concepts within social cognitive theory. The analysis employs data from a large-scale elementary school computing intervention in the Southeastern United States. We conclude with a discussion of the implications of the presented research and some potential directions for future research.

2. Literature Review

2.1. Digital Inequality: Hardware to Self-Efficacy

Recent discussions of digital inclusion and inequality have shifted from a focus on hardware access to a more nuanced and multidimensional perspective (van Deursen & van Dijk, 2013). Perhaps most prominently, van Dijk and Hacker (2003) propose that there is not a singular access gap but rather four distinct access gaps. The first is a mental access gap which also referred as motivational access gap in van Dijk's later work (van Dijk, 2005). The mental/motivational access gap is an emotional gap relating to people's unwillingness to use ICTs and their lack of interest ICTs, stemming from a lack of elementary experience with ICTs. The second gap is a material access gap, which posits that people simply do not have access to computers or the Internet. The third gap, skills access gap, focuses on how people with differing levels of ICT experience develop different skill levels. The final gap is a usage access gap, which posits that people with different ICT experiences will develop different usage patterns and habits.

These diverse access gaps and discrete levels of the digital divide now receive increased attention. Van Dijk and Hacker (2003) point out that mental access may lead to a kind of "computer anxiety" which turns "information have-nots" into "information want-nots." Similar to the concept of mental access, further studies have found that due to temporal barriers (such as having to share a family computer) and physical barriers (such as having to find transportation to a library) many of today's youth have to deal with what are termed emotional costs (Robinson, 2009). Emotional costs are feelings of anxiety or stress that can be associated with using computers. Also, long-term material deprivation causes students to experience negative emotions such as low self-efficacy or high anxiety when they use ICT (Robinson, 2014). In the context of a computing intervention, Huang, Robinson, and Cotten (2015) found that students' emotional costs, as an extension of mental access, had a negative impact on students' self-perceived technology efficacy. In sum,

mental access and self-efficacy have become more important issues when discussing digital inclusion and the different forms of digital inequalities. In the following section, we review the literature on factors that influence the formation of self-efficacy.

2.2. Factors Forming Self-Efficacy in the Classroom: Enactive and Vicarious Experiences

Previous research has shown that self-efficacy plays an important role in students' learning in the classroom setting, such as physics (Kapucu & Bahçivan, 2015), chemistry (Boz, Yerdelen-Damar, Aydemir, & Aydemir, 2016), and mathematics (Ng, Lay, Areepattamannil, Treagust, & Chandrasegaran, 2012). One study found that high school students' self-efficacy had an effect on their chemistry achievement and also mediated the relationship between students' perceptions of their learning environment and their chemistry achievement (Boz et al., 2016). In other words, self-efficacy can not only affect students' achievement but also influence the effects of their learning environment on achievement. Therefore, we need to understand how self-efficacy is formed in the classroom.

Regarding the formation of self-efficacy, Bandura (1977, 1994, 2004) expanded upon traditional environmental and impulse-based learning theories to posit a conception of humans as proactive and self-reflecting. The three intellectual cornerstones of modern social cognitive theory form the theoretical foundation for the present study: self-efficacy, enactive experience, and vicarious experience. Self-efficacy refers to people's beliefs about their ability to perform an action, such as completing a task or reaching a goal. Moreover, self-efficacy influences how people think, feel, and motivate themselves to behave (Bandura, 1994). Thus, self-efficacy becomes a powerful indicator to predict motivation and accomplishment. The underlying logic follows that if an individual does not believe that they possess the skills or ability to perform a task, then they will be less likely to even attempt to perform said task. Conversely, if they have a strong belief in their ability to carry out a particular task, then their likelihood of attempting that task increases substantially (Peng, 2008). Self-efficacy is also related to many other cognitive processes, such as the ability to recover from failure and persist in the face of challenges. Therefore, self-efficacy is an essential element for overcoming the multitude of situations that present themselves across the many stages of life.

Bandura (1994, 2004) posits that there are four ways to influence self-efficacy; however, we focus on two of the most important for this study. The first and most effective is enactive experiences (Bandura, 2004). Enactive experiences are experiences in which individuals develop beliefs about their ability to perform an action by interpreting the results of their actual behaviors (Pajares, Prestin, Chen, & Nabi, 2009). Individuals have a direct experience in which they actually carry out a set of actions. In essence, individuals interpret outcome feedback in order to develop their knowledge and skills through practice (Wei, Teo, Chan, & Tan, 2014). Enactive experience can have a substantial impact on an individual's self-efficacy because success will boost efficacy beliefs while failure will detract from it. Empirical studies reveal that enactive experience can be a source of support and self-efficacy when middle school students are learning mathematics (Usher, 2009) and science (Kiran & Sungur, 2012). Research on technology-focused efficacy also indicates that students' technology ownership, total amount of technology use, and specific media usages (e.g., email use) had a positive association with technology self-efficacy (Shank & Cotten, 2014). Therefore, we hypothesize that students' enactive experiences, which we operationalized as their direct experience of computer usage, will have higher self-perceived technology efficacy and STEM attitudes (H1).

Vicarious experiences are the second means to influence self-efficacy. In this case, an individual observes a social model perform certain actions (Pajares et al., 2009; Peng, 2008). As a source of self-efficacy, vicarious experiences transmit knowledge and skills to observers about effective actions (Wei et al., 2014). The success or failure of the social model then affects the self-efficacy beliefs of the observer. Thus, observing the success of others boosts the beliefs that an individual possesses regarding their ability to also perform the observed task. Likewise, observing failure can undermine an individual's belief in their ability to succeed. The vicarious relationship strengthens depending on the perceived "closeness" or similarity of the social model with the observer (Bandura, 1994; Benight & Bandura, 2004). For instance, the vicarious impact of a student observing another student/peer, that is also perceived to be close in ability, will have a greater impact than observing a teacher. Vicarious experiences provide an action template to the observer as they see what actions lead to successful outcomes.

Vicarious social models can come in many forms and can even be mediated through television (Bandura, 2004) and video games (Peng, 2009). Previous research examining the influence of social learning environments on students' science and math self-efficacy found that peer-based vicarious experiences are indeed a source of self-efficacy (Joet, Usher, & Bressoux, 2011; Kiran & Sungur, 2012; Usher, 2009). Furthermore, other studies reveal that students vicariously acquire science efficacy (Kiran & Sungur, 2012) or ICT self-efficacy (Aesaert & van Braak, 2014) from the adults around them. Research on technology-focused interventions also suggests that teachers' computer efficacy plays an important role in technology education (Paraskeva, Bouta, & Papagianni, 2008) and may have direct impacts on student's digital literacy (Zhu, Yang, MacLeod, Yu, & Wu, 2019). Therefore, we hypothesize that students' vicarious experience, which is operationalized as students' perception of their teacher's computer usage, will positively influence students' technology self-efficacy and STEM attitudes in the context of a computing intervention (H2).

Although both enactive and vicarious experiences are sources of self-efficacy, enactive experiences are more powerful when forming self-efficacy beliefs (Peng, 2008). Previous research examining students' math self-efficacy found that enactive experience is a stronger predictor than vicarious experience (Joet et al., 2011). Therefore, we hypothesize that enactive experiences, compared to vicarious experiences, will have stronger predictive power regarding students' technology efficacy and STEM attitudes (H3).

3. Methods

3.1. Data Collection

The data for this study was collected from a computing intervention that involved 12 public schools in a large, high poverty, minority, urban school district in the Southeastern United States. The demographic composition of the school district, 88% of students receiving free or reduced-price lunches (which is a proxy for poverty levels) and 95% African Americans, made it an ideal setting for an intervention focused on increasing the number of minority students interested in STEM fields and careers. Fourth and fifth grade teachers and students participated in a number of computer-based activities throughout the intervention. Specifically, teachers participated in numerous computer-based trainings during the year where they learned to integrate computing across their curriculum. Trainings focused on blogging, computer programming, creating tables and graphs, and various other activities to promote student interest in STEM.

Students enrolled in these schools were asked to complete surveys at the beginning (Fall 2012) and the end (Spring 2013) of the school year. A total of 123 teachers participated in the intervention, while 73 teachers were involved in an intensive summer workshop. Students voluntarily participated and received an incentive regardless of their completion of the surveys. Over 95% of the students participated in either the pretest or posttest survey. A total of 1,201 students participated in both surveys. Observations with missing data on the predictors of interest were excluded from the analysis, which reduced the sample from 1,201 to 976 students. There were no significant differences in the results after excluding observations with missing data.

3.2. Dependent Variables

The surveys included a series of items which measured students' computer usage and attitudes toward computers and STEM fields during a computing intervention. The dependent variables included in this study are: (1) self-perceived technology efficacy and (2) STEM attitudes. The self-perceived technology efficacy scale included five questions asking students to rate their skill level while using the following ICTs (e.g., computer or laptop and Internet). The response option values for each dimension (0 = not at all, 1 = only a little, 2 = some, 3 = a lot) were summed and averaged. The STEM attitudes scale items included nine questions asking students whether they agreed or disagreed with statements such as: I think science is cool and I think math is cool. Both scales have been validated in previous research on STEM education (e.g., Ball, Huang, Cotten, & Rikard, 2017; Huang et al., 2015). Negatively phrased questions were reverse coded and the response option values for each dimension (0 = disagree, 1 = not sure, 2 = agree) were summed and averaged. To control the effects of dependent variables in the pretest on the same variables in the posttest, both pretest and posttest variables were included in the data analyses.

3.3. Independent Variables

The independent variables of interest included: (1) enactive experience, which refers to students' computer usage and (2) vicarious experience, which refers to students' perception of their teacher's computer usage in class. The enactive experience scale consisted of 11 items asking students to report how often they use computers to do things such as homework and research. The vicarious experience scale consisted of nine items asking students to report how much their teacher used various software in class such as Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. The response option values for each dimension (0 = not at all, 1 = only a little, 2 = some, 3 = a lot) were summed and averaged.

3.4. Control Variables

Sex, race, and grade served as the control variables in the analyses. Sex (0 = female, 1 = male) and race (0 = African American, 1 = non-African American) were recoded as dichotomous dummy variables, with female and African American respondents being the excluded category. Students' grade was also recoded as a dichotomous dummy variable (0 = fourth grade, 1 = fifth grade) and fourth grade students were the excluded category. This study did not include a measure of socioeconomic status in the analyses due to a lack of variation in students' socioeconomic backgrounds.

3.5. Data Analysis

First, we report the descriptive statistics for the variables of interest. Second, the variables were used in a series of Ordinary Least Squares (OLS) regression models. Hierarchical Linear Modeling was also considered, but none of the intraclass correlation coefficients for the relationship between-school and between-class clusters and the dependent variables were large enough for us to use it. The OLS regression models investigated the relationship between the predictors (i.e., enactive and vicarious experiences) and our outcome variables (self-perceived technology efficacy and STEM attitudes). Three models

pertaining to each dependent variable were created for this research. The first model included our dependent variables measured in the pretest while controlling for sex, race, and grade. Given that the outcome variables in the pretest may have a strong impact on the same outcome variables in the posttest, we controlled for the effects of the outcome variables in the pretest by adding students' self-perceived technology efficacy or STEM attitudes into the first model. Next, we tested for a relationship between the posttest vicarious experience and the posttest outcome variables in the second model. Lastly, the posttest direct experience was added into the regression model to see if vicarious experience was weakened by the inclusion of direct experience.

4. Results

4.1. Descriptive Statistics

Table 1 presents the descriptive statistics for the variables of interest. Approximately half (50.2%) of the participants were male, and 54% of the participants were in the fifth grade. Students had some enactive experience ($\bar{X} = 1.60$) but low scores on vicarious experience ($\bar{X} = 0.89$) on average. The majority of the students had relatively strong inclinations toward STEM fields at the pretest ($\bar{X} = 2.46$) and posttest ($\bar{X} = 2.41$), and the strength of their STEM attitudes at pretest and posttest showed no significant difference. For their technology efficacy score, participants had an average score of 3.21 on the pretest and 3.47 on the posttest.

4.2. Regression Analyses

4.2.1. Self-Perceived Technology Efficacy

Table 2 presents the three OLS regression models. Sex, race, grade, and self-perceived technology efficacy at the pretest were entered into Model 1 (see Table 2). Students' self-perceived technology efficacy ($\beta = 0.397$, $p < 0.001$) and grade ($\beta = 0.069$, $p < 0.01$) had a significant impact on students' technology self-efficacy in the posttest. The second model added the measure of students' vicarious experience. The results showed that students' vicarious experience ($\beta = 0.091$, $p < 0.01$) significantly predicted students' technology efficacy after the computing intervention. Students who had higher scores on vicarious experience were expected to have higher scores on self-perceived technology efficacy.

However, after adding students' enactive experience in the third model, the coefficient of vicarious experience decreased by 82.4% and was no longer significant. Students' enactive experience predicted their self-perceived technology efficacy in the posttest survey ($\beta = 0.272$, $p < 0.001$). The effect of vicarious experience on students' self-perceived technology efficacy was

Table 1. Descriptive statistics of variables.

Variable	Mean	Std Dev	Min	Max
Sex (1 = male)	0.50	0.50	0.00	1.00
Race (1 = non-African American)	0.18	0.38	0.00	1.00
Grade (1 = fifth grade)	0.54	0.50	0.00	1.00
Self-perceived technology efficacy (Time1)	3.21	0.83	0.00	4.00
Self-perceived technology efficacy (Time2)	3.47	0.64	0.00	4.00
STEM attitudes (Time 1)	2.46	0.34	1.00	3.00
STEM attitudes (Time 2)	2.41	0.34	1.00	3.00
Enactive experience	1.60	0.51	0.00	3.00
Vicarious experience	0.89	0.61	0.00	3.00

Note: N = 976.

Table 2. OLS regression analysis of student's self-perceived technology efficacy and STEM attitudes regressed on enactive and vicarious experience.

Variable	Self-perceived technology efficacy			STEM attitudes		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Sex	0.025	0.027	0.035	0.126***	0.129***	0.135***
Race	−0.028	−0.024	−0.030	0.010	0.018	0.017
Class grade	0.069**	0.066**	0.055	−0.089**	−0.095**	−0.104**
DV in the pretest	0.397***	0.394***	0.325***	0.318***	0.302***	0.288***
Vicarious experience		0.091**	0.016		0.155**	0.110***
Enactive experience			0.272***			0.160***
F	48.579***	41.157***	50.376***	38.235***	36.865***	36.151***
Adj-R^2	0.163	0.171	0.233	0.133	0.155	0.178

Notes: N = 976; *p < 0.05. **p < 0.01. *** p < 0.001. Sex: 1 = male; Race: 1 = non-African American; Class Grade: 1 = fifth grader.

weaker than their enactive experience of actually using a computer.

5. Discussion

The impact of digital inequalities and the subsequent need for digital inclusion has been examined across a broad range of life chances and life trajectories (Robinson et al., 2015). The present study investigated how different types of experiences link to inequalities and influence students' self-perceived technology efficacy and STEM attitudes in the context of a large-scale computing intervention. The results show that students who had more enactive experiences related to their direct usage of computers had higher technology-related self-efficacy and STEM attitudes compared to students that had fewer enactive experiences. The findings support the first hypothesis and articulate the importance of usage access to increase digital inclusion. Also, the results indicate that students' vicarious experiences related to observing their teachers' technology use had a positive influence on their technology efficacy. However, the effects of students' vicarious experiences on students' self-perceived technology efficacy were mediated by enactive experiences. In other words, the second hypothesis of this research was partially supported. When comparing enactive and vicarious experiences, the regression results show that enactive experiences had stronger effects than vicarious experiences on students' self-perceived technology efficacy and STEM attitudes, which supports the third hypothesis.

Overall, by building our research based on Bandura's (2004) social cognitive theory, we examined factors influencing the formation of self-efficacy in both enactive and vicarious experiences and found that enactive experience indirectly influenced the predictive power of vicarious experience on students' self-perceived technology efficacy. To be more specific, the influence of students' vicarious experience on their technology efficacy was actually based on their computer usage. When controlling for the effects of enactive experience, vicarious experience was no longer a predictor. Rather, students' enactive experience, which was positively related to their vicarious experience, was the main source of students' technology efficacy. The findings articulate the importance of both enactive and vicarious experiences related to the direct effects of using computers and the indirect effects of observing a model to increase digital inclusion with young, urban, minority students. In sum, we found that high technology self-efficacy was associated with computer experience, both directly (direct experience) and indirectly (vicarious experience).

Our results connect research on access and usage inequality to research on affective factors of using technology by illustrating how increased computer usage and observational experience can help digitally disadvantaged students receive tangible outcomes (i.e., interest in STEM fields). The conception of digital inequality encompasses more than a simple lack of ICT access. Digital Inequality followed by limited access includes a lack of self-confidence and inclination toward STEM fields, which later acerbates existing offline inequalities (van Deursen, 2015). Hence, when students experience limited opportunities for enactive and vicarious learning then a subsequent lack of technology self-efficacy will perpetuate already present hindrances. Lower technology self-efficacy in conjunction with other digital inequality factors could affect certain computer usage patterns in the future. Therefore, to increase digital inclusion we must provide opportunities for students improve their self-efficacy with ICTs via direct experiences.

Regarding the effects of vicarious experience, we found that observing teachers provided students with increased opportunities to develop STEM attitudes after controlling for the effects of enactive experience. That is, once students gain the experience of watching their teachers use various computer programs, often they may develop more positive attitudes toward STEM-related fields. Finally, we found that students' enactive experiences did, indeed, have a greater impact on their technology efficacy when compared to the impact of observing their teacher's computer usage. These findings help us to better understand the mechanisms associated with the formation of technology self-efficacy which can help improve digital inclusion in the context of a computing intervention. As previous studies have shown, the digital divide is an increasingly multi-dimensional issue that has expanded beyond simple ICT access. Our study demonstrates the importance of experiences, in addition to access, to increase digital inclusion via technology self-efficacy for digitally disadvantaged students. In summation, the enactive experience of computer usage helps students form their technology-related self-efficacy directly and also indirectly influences their technology efficacy via the routes of vicarious experience.

6. Limitations

In light of these findings, we acknowledge that there were some limitations inherent in the present research. First, the computing intervention took place in a high poverty urban school district in the Southeastern United States. These results provided evidence that the intervention was successful at increasing the technology efficacy of students in low socioeconomic status areas. However, these results may be less applicable to students from other socioeconomic backgrounds.

Second, our sample was primarily African American (82%). Therefore, these findings may not be completely generalizable to students from other racial/ethnic groups. In other words, we are unable to determine if enactive and vicarious experiences impact all racial/ethnic students the same way or if the effects found here only apply to African American students from low socioeconomic status, high poverty school districts in the Southeast.

Third, due to the limited answer variety, the reliability of some of the measures was relatively low. However, it is normal to have relatively low reliability when analyzing survey data from very young respondents (Newman & McNeil, 1998). Finally, some potentially important measures were not included in this study. First, we did not include any measures of the actual hours of computer use for students. Second, we did not include any measures of how good teachers were at using the different applications. Third, we did not have any measures related to students vicariously observing peers. Future studies should consider including these measures for a better understanding of the effects of enactive and vicarious experiences.

7. Conclusion

Given these limitations, our research still offers several contributions to the literature surrounding the relationship between digital inclusion, digital inequality, and other forms of inequality. First, our research found that students' enactive experience, which refers to their computer usage, was an important factor for increasing children's technology efficacy and STEM attitudes in the context of a computing intervention. Specifically, we found that simply providing students access to digital devices would not be enough to increase their technology efficacy or trigger their STEM attitudes. Instead, we found that increasing their actual computer usage was the key factor for increasing technology efficacy and STEM attitudes. Therefore, future computing interventions seeking to improve digital inclusion should focus their attention on increasing students' actual computer usage through enactive experiences.

Second, our research revealed the impact of vicarious learning experiences on students' STEM attitudes. When students perceived their teachers using computer programs more often, they had higher STEM attitudes. This finding also showed the importance of teachers' roles in promoting STEM education. To improve digital inclusion, computing interventions should tailor pedagogical approaches that bolster computer usage (enactive experiences) and teachers' technology usage in the classroom, which students subsequently observe and internalize (vicarious experiences), especially among digitally disadvantaged students. In the end, these findings indicate that there is a potential opportunity for school districts to trigger minority students' interest in STEM fields via digital inclusion by creating positive opportunities for both enactive and vicarious learning experiences.

Third, previous research has posited that affective experiences may account for some of the negative attitudes and phobias that minority students hold towards using technology (e.g., Jackson, Ervin, Gardner, & Schmitt, 2001). We further identified that different enactive and vicarious experiences may shed light on why students develop different attitudes toward STEM fields. For instance, even after gaining access to classroom computers, different levels of actual computer usage may still impact students' computer self-efficacy and STEM attitudes. Therefore, both enactive experiences, as well as vicarious experiences, might be key components for improving digital inclusion and reducing digital inequalities moving forward.

Finally, for theoretical implications, there is limited empirical research that focuses on vicarious experience as a source of self-efficacy formation, especially in the context of computing education. This study discloses the mechanisms behind the formation of self-efficacy in the context of a large-scale computing intervention by providing empirical evidence that both enactive as well as vicarious experiences provided sources of technology self-efficacy and STEM attitudes. Furthermore, enactive experience has both direct and indirect effects on student's self-efficacy. For practical implications, school districts seeking to improve digital inclusion should focus on students' enactive experiences, with direct computer usage experiences, in the context of computing or computer-based education, since it is a powerful source of forming self-efficacy. Also, school districts should provide students with more opportunities for vicarious experiences, such as observing teachers' technology usage, since it is a source of STEM attitudes. Future studies should examine the effects of various sources of self-efficacy on the different levels of digital inequality, such as mental access and skills access inequalities, and whether or not these various sources of self-efficacy may have interaction effects on STEM learning.

Over the past several decades we have gained a deep understanding of the kinds of digital inequalities that exist between students; however, we must now look for different kinds of experiences that may increase digital inclusion. The results presented here indicate that enactive and vicarious experiences should be considered during the design of future digital inclusion interventions so that they can become more focused on the experiences associated with the act of computing rather than a sole focus on computers. Advancing digital inclusion will involve more experiential rather than material factors moving forward.

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Conflict of Interests

The authors declare no conflict of interests.

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Article

Technological Socialization and Digital Inclusion: Understanding Digital Literacy Biographies among Young People in Madrid

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Abstract
The main goal of this article is to analyze young people's technological socialization experiences to build a comprehensive model of the distinctive digital literacies interwoven with their biographies. Considering that digital accessibility is a necessary but not sufficient condition for inclusion, we identify which types of digital literacies are linked to the acquisition of digital competencies, confidence, and dispositions towards the incorporation of ICTs into daily activities; on the other hand, we also identify digital literacies that might engender motivated processes of self-exclusion from the digital realm, therefore reinforcing subjects' digital exclusion. Methodologically, this article is based on 30 in-depth biographically-oriented qualitative interviews with young people living in the region of Madrid, Spain. Regarding results, four techno-social dimensions are proposed—motivation, degree of formality, degree of sociality, and type of technological domestication—to construct a typology of four ideal forms of digital literacy: unconscious literacy, self-motivated literacy, professional literacy, and social support. To achieve digital inclusion, self-motivation towards using digital technologies is mandatory, but social practices, academic and professional literacy might work as a secondary socialization process that enhance subjects' affinity with ICTs. Nevertheless, the effect of social support is ambivalent: It could promote digital inclusion among people already interested in digital technologies, but it could also lead to dynamics of self-exclusion among people who are not confident regarding their digital competencies or disinterested in ICTs.

Keywords
digital divide; digital inclusion; digital literacy; technological socialization; young people

Issue
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1. Introduction

As empirical research on digital inequalities has shown (Lupač, 2018), digital inclusion cannot be achieved just by granting access to digital devices—first-level digital divide—or by increasing the level of digital skills—second-level digital divide (Hargittai, 2002; van Deursen & van Dijk, 2014). It is also crucial to generate social spaces of domestication of technology (Silverstone, 1993), focusing on the offline outcomes that people obtain with the use of ICTs—third-level digital divide (Ragnedda, 2017)—and on the incorporated dispositions and experiences of use (Huang, Robinson, & Cotten, 2015). Regarding this, we will analyze young people's technological socialization experiences to develop a comprehensive model of the influence of digital literacy processes in engendering digital inclusion among young people.

Firstly, digital inclusion can be defined as "the ability of individuals and groups to access and use information and communication technologies" (Institute of Museum and Library Services, University of Washington, & International City/County Management Association, 2012, p. 1) which is constrained by the different digital divides that affect people's opportunities to participate in society: Quality of access (Ghobadi & Ghobadi, 2015), digital skills (Hargittai, 2002), forms of use (van Deursen & van Dijk, 2013), motivation (van Deursen & van Dijk,

2015), emotional barriers (Huang et al., 2015), or offline outcomes and benefits (Ragnedda, 2017) are some of the main dimensions of digital divide research. Thus, digital inclusion and the digital divide are two sides of the same coin, since the digital divide focuses on empirical research about new forms of inequality related to the information society. Reversely, digital inclusion refers to the political intervention among digitally deprived social groups to improve their possibilities to participate in digital society.

Consequently, if participation in digital society is determined by not only material accessibility to digital equipment, services, and tools, but also by subjects' internalized knowledge, digital skills, and dispositions towards technology, to reconstruct people's itineraries of socialization in the use of ICTs, we need to focus on two entangled dimensions: (1) the domestication of technology (Silverstone, 1993), which is related to the particular ways of appropriation and incorporation of digital tools to life, and (2) digital literacies (Erstad, 2011), which refers to the distinctive dispositions, competencies, and attitudes subjectively internalized during the biographical process of domestication of technology. Material and economic aspects can only explain a small part of the many ways in which the Internet is used, which is also associated with the development of particular Internet cultures (Dutton & Reisdorf, 2019), digital experiences, and attitudes towards the use of digital technologies. It is important to mention, also, the continuities of digital literacies and other forms of cultural literacy (Livingstone, 2008), rejecting the radical split between online and offline spaces of social activity. On the contrary, subjects interact in a digitally mediated world (Lasén & Casado, 2014) in which the frontiers between online/offline literacies are blurred since cultural background decisively affects people's itineraries of technological domestication and, reversely, the digital skills acquired can be converted into higher levels of cultural capital (Ragnedda, Ruiu, & Addeo, 2019). Therefore, we need to develop a comprehensive model of digital literacy processes that take into account the differential forms in which people incorporate digital technologies into social spaces of interaction during their lived biographies.

2. Building a Comprehensive Model of Digital Literacies

To theorize a comprehensive model of digital literacies, we need to analyze the distinctive dimensions that configure the forms of incorporating digital technologies into daily practice. In this sense, we will analyze subjects' digital literacies taking into account the following dimensions:

A. Temporality: It refers to the duration of the process of acquisition of skills and dispositions since some literacies are concentrated in specific moments of intense use—for instance, conscious learning of specific digital skills in specific social contexts like school or work, whilst others are continuously produced over the course of life through ordinary digital activity. As Robinson (2009) points out, the disinterested use of technology is extremely important in terms of acquiring dispositions and confidence, as it could lead to an informational advantage of those subjects who are more familiar with the use of ICTs.
B. Motivation: In the famous 4-gap model of the digital divide (van Deursen & van Dijk, 2015), motivation is the first factor that conditions digital appropriation, as skills acquisition is extremely interwoven with motivated forms of incorporating digital technologies into ordinary activity. In such activity, personal dispositions, confidence, and familiarity with the different potentialities of ICTs are also internalized. Hence, it is important to analyze how personal dispositions, interests, and attitudes shape how subjects use digital technologies through their biographical trajectories, engendering particular dynamics of digital literacy that could affect later life stages in terms of digital inclusion. This is important because even if most digital practices are socially mediated, there is always a motivational aspect involved in subjects' digital activity, which is internalized through their biographical socialization in contact with technology.
C. Degree of formality: It refers to the degree of structuration and formalization of the internalized competencies and skills. In this sense, we need to take into account two distinctive forms of literacy (Sefton-Green, Nixon, & Erstad, 2009): (1) top-down literacy, in which a structured pack of formal skills is proposed by social institutions and organizations as basic competencies needed to get along in the digital era—like e-educational formative programs, and (2) bottom-up literacy, in which the focus is put on micro-social processes of acquiring informal competencies, attitudes, and awareness of the potentialities of digital devices. The first type of literacy is linked to clearly-established digital skills, whilst the second one refers to more informal dispositional competencies and experiences that affect digital practices.
D. Degree of sociality: Despite individual motivation, most digital practices are socially mediated, so personal biographies of socialization on the use of ICTs are also conditioned by the social context of interaction. In this sense, social support (van Deursen, Courtois, & van Dijk, 2014) is a crucial process through which people can acquire new digital skills and be aware of new features and possibilities of digital devices. Hence, it is important to understand the effect of social resources on engendering digital literacies and, therefore, granting digital inclusion among people, since the specific socio-cultural context in which people are socialized conditions their digital accessibility and digital practices.

E. Type of devices: Digital literacies are based on specific processes of domestication of technology (Silverstone, 1993), which constitute the objectified material grounds on which personal dispositions can be embodied. In this sense, we will take into account the different technological devices and forms of accessibility present among people and their relation to distinctive forms of literacy. Particularly, the distinction between computer-oriented literacy and smartphone-oriented literacy will be considered, since previous research has shown relevant asymmetries between these two forms of accessibility (Pearce & Rice, 2013).

From the previous five dimensions that condition technological domestication, we have developed an ideal typology of four distinctive forms of digital literacy that can be tracked among subjects' biographical narratives (Table 1). The first two forms (unconscious and self-motivated literacy) refer mainly to personally-oriented experiences of contact with ICTs, whilst the second two (professional literacy and social support) are much more socially-oriented and depend on social spaces of interaction in which subjects participate. Hereunder we introduce these four literacies and their theoretical articulation, whilst in Section 4 we will develop and discuss them concerning the empirical material.

Type 1. Unconscious literacy: It is the most important form of digital literacy, referring to the involuntary process of incorporating dispositions and competencies during the continuous domestication of technology through life. In terms of temporality, unconscious literacy is a long-term process inherently associated with the use of digital devices at different stages in life, taking into account the different contexts of use in which ICTs are needed. Therefore, the level of motivation is high, but associated with the ordinary use of devices as means for particular ends—what Robinson (2009) calls disinterested forms of use—instead of directly linked to the acquisition of new digital competencies. In contrast, the degree of formality and sociality are generally low, although it is logical to assume that every other form of digital literacy is partially based on this continuous process of internalizing dispositions as structured and structuring structures: in Bourdieu's (1979) view, dispositions derived from social positions of activity but also dispositions as generative principles for new actions. Such dispositions are biographically embodied in long-term processes of social interaction in distinctive social fields in which they are put into practice, so subjects usually deploy them strategically even if they are not aware of it (Kvasny, 2006). As the more generalized form of literacy, unconscious literacy is associated with every technological device: in a long-lasting biographical experience, users learn not only how to technically operate devices but also particular ways in which, in their social worlds, these devices become practically useful.

Type 2. Self-motivated literacy: It is an individualistic literacy in which users consciously try to acquire a specific digital skill or learn how to use digital technologies in a particular way. Hence, self-motivated literacy is generally based on subjects' perceptions of their lack of competency for fulfilling a particular task required in their social life. In these cases, they proactively invest time and effort in learning this concrete digital skill using tutorials, guides, courses or any other formative option. Temporarily motivated literacy is occasional, since it is concentrated in specific moments of intense effort rather than extended over time. The level of motivation required is also high, like in unconscious literacy, but in this case, the focus is placed on the development of new digital skills rather than on the ordinary use of technology. Consequently, the level of formalization of this literacy is extremely high, but the level of sociality could vary: It is high in the case of formative courses and social activities related to digital capacitation, but it is low in the case of personal use of online tutorials and guides. In terms of domestication, this kind of literacy is usually linked with a computer, since the self-perceived lack of digital skills is more common around this device. Computers are usually associated with more productive forms of use (Pearce & Rice, 2013), so certain users perceive the necessity of fulfilling certain digital tasks that require the use of this equipment but lack the specific knowledge or competencies to do it.

Type 3. Professional literacy: It can be defined as an top-down form of literacy (Sefton-Green et al., 2009) since it refers to social contexts in which the use of digital devices is linked to very formalized prac-

Table 1. Processes of digital literacy.

Type of literacy	A. Temporality	B. Motivation	C. Degree of formality	D. Degree of sociality	E. Type of devices
T.1. Unconscious literacy	Continuous	High	Low	Low	All
T2. Self-motivated literacy	Occasional	High	High	Low	Computer
T3. Professional literacy	Both	Medium	Medium	High	Computer/Smartphone
T4. Socio-interactive literacy	Both	High/Low	Medium	High	Computer/All

Source: Own elaboration.

tices: mainly academic contexts, from school to university, and the labor market. In this case, temporality is ambivalent, since work and the education system are long-term spaces of socialization along with people's biographies but, at the same time, technological domestication and literacy are generally confined to occasional moments of intense use of digital devices. This is why professional literacy requires a medium level of motivation since the level of proactivity and interest in internalizing new digital competencies is generally lower than self-motivated literacy but higher than unconscious literacy, in which the focus is the practice itself rather than the competency. Also, among professional literacy, the level of sociality is high since digital practices are entangled with the requirements of the social contexts in which they are deployed—this is particularly important in the case of the labor market. Finally, like self-motivated literacy, professional literacy is usually linked with the use of computers rather than other devices, although mobile phones are becoming more and more present in some professional ambits.

Type 4. Social support: The last form of literacy, of which the main characteristic is its high degree of sociality, is social support (Courtois & Verdegem, 2016; van Deursen et al., 2014), which can be defined as one's potential opportunities of taking advantage of acquaintances' digital competencies to deploy digital practices without the knowledge needed to do it autonomously. In sum, it refers to the possibilities of mobilizing social capital to increase the variety of digital tasks that people can fulfill. In terms of temporality, social support is occasional and limited to particular moments in which the necessity of completing a certain task is crucial. In terms of motivation, the situation is ambiguous, since social support can include a high level of motivation in those cases in which subjects are interested in learning new skills or an extremely low level of motivation in the opposite cases, in which subjects are not interested in learning but just in fulfilling a certain task. Regarding the rest of the characteristics of social support, this kind of literacy includes a high level of formality—since the main objective is the specific task itself—and it is linked to all digital devices, although it is extremely relevant in the case of computers.

3. Methodology

This article is based on 30 qualitative in-depth interviews carried out in the region of Madrid, Spain, between 2017 and 2018, covering the city of Madrid and localities in the metropolitan area. The sample includes subjects between ages 18 and 35 who use the Internet frequently, so we have not considered in our sample the group of people physically excluded from digital technologies and, therefore, affected by the first-level digital divide (see Mariën & Prodnik, 2014; Reisdorf & Groselj, 2017). Therefore, we have developed a structural sample design (Valles, 2014) based on the theoretical representation of three socio-demographic variables: gender, generational position, and educational level. In Table 2 we present the sample design, in which all the crosses between variables have been considered, except for people between ages 18 and 22 with higher education, which is theoretically impossible because of their age.

Gender is an important variable in terms of the second-level digital divide (Antonio & Tuffley, 2014; Haight, Quan-Haase, & Corbett, 2014), in which focus lies on the distinctive digital practices developed by users in terms of their motivations, digital skills, and dispositions towards technology. In the Spanish case, this is extremely relevant, since the gender digital divide has been one of the more productive fields of research in recent years (Castaño, Martín, & Martínez, 2011).

Regarding generational position, as Bolin (2018) points out, dispositions to ICTs acquired during childhood and adolescence can affect later life stages in terms of digital practices, engendering distinctive generational identities that are nevertheless constrained by other socio-economic and cultural conditions. This is why we have divided our sample into three generational groups to compare differential processes of technological socialization among young people during different life stages: ages 18–22, ages 23–29, and ages 30–35.

On educational level, as recent studies demonstrate (Dutton & Reisdorf, 2019; Haight et al., 2014; Mariën & Prodnik, 2014), cultural and educational capital are some of the more important variables to explain the second-level digital divide, in contrast to economic capital, which is more relevant to understand material accessibility (first-level digital divide). This is why we have included in our sample a comparison between 16 subjects with secondary education and 14 subjects with higher education.

Table 2. Qualitative structural sample.

Educational level	Age group 18–22 years old	23–29 years old	30–35 years old
Secondary studies	6 interviews (2 men; 4 women)	9 interviews (6 men; 3 women)	1 interview (1 man; 0 women)
Superior studies	0 interviews (0 men; 0 women)	9 interviews (3 men; 6 women)	5 interviews (2 men; 3 women)

Source: Own elaboration.

Regarding discourse analysis, we used a socio-hermeneutic biographical approach (Alonso, 1998; Wengraf, 2001), which focuses on the pragmatic dimension of language, reconstructing subjects' life stories in the use of digital devices. Hence, we will identify the distinctive ways in which people incorporate ICTs into their practices and the phenomenological internalization of dispositions towards technology.

4. Results: Digital Literacies as Paths for Digital Inclusion

Through the qualitative analysis of the interviews, it became evident that digital literacy isn't a homogeneous process since it is closely interwoven with the particular itineraries of technological domestication throughout life. Thus, four distinctive forms of digital literacy have been reconstructed and will be hereunder developed across the subjects' narratives: (1) unconscious literacy, referring to the involuntary acquisition of dispositions during digital practices, (2) self-motivated literacy, referring to the voluntary learning of certain skills, (3) professional literacy, linked to the formally social contexts of use of ICTs, and (4) social support, referring to the mobilization of social capital to improve competencies and fulfill digital tasks.

4.1. Unconscious Literacy

> I always had the theory that you only learn by doing….By using the Internet, eventually you learn how to use it. I still see people who even nowadays are not familiar with it, but as I have to use things, in the end I learn how to do it. (Man, b. 1988)

Unconscious literacy is the most basic form of digital literacy, related to the internalization of digital competencies, attitudes, and dispositions towards ICTs. This is embedded in technological domestication processes, that is, in quotidian digital practices in which technology is incorporated into personal practices. It has become clear among the interviews that beyond specific digital skills, which are required in certain social contexts, the more important forms of digital literacy are related to the acquisition of familiarity, confidence and pro-technology attitudes, which could engender future process capacitation in the use of such devices and tools. Regarding this, although unconscious literacy is present among all users, whose objectified digital practices are phenomenologically incorporated as dispositions in their habitus, it is also clear that a long-term process of socialization in the use of digital devices for different purposes is crucial to acquiring confidence, familiarity, and awareness of their potentialities. Hence, good quality of access is a necessary but insufficient condition to develop a more flexible and advanced techno-biography in terms of digital literacy. Cultural and social variables are also extremely relevant in acquiring interests and motivation towards the use of new features of the digital world. In the end, as it is shown in the extract below, every user relies on their internalized digital competencies and interests towards digital tools to increase their digital competencies:

> I think I use the Internet until I don't know how to do something and, generally, when I can't do something, it's over. I think we are forced to do it yourself logic, you need to fix problems on your own when in the end reality is quite the opposite: no one is an expert on computers. And I also think our resources are scarce, we don't know how to properly use apps or programs such as Excel….I feel it daily, constantly, you have the opportunity to learn new things but you almost always rely on yourself, even if you can look it up on google to learn. (Woman, b. 1993)

In this sense, there is an important divide between those users who have developed a long-term process of socialization in the use of personal computers since childhood and adolescence in comparison with those subjects whose accessibility has mainly been associated with the use of smartphones and other devices. As some authors remark (Lee, Park, & Hwang, 2015), computer-oriented users usually develop more flexible patterns of use of the Internet than smartphone-oriented users, so having experienced a longer process of computer literacy could become an informational advantage in terms of the offline outcomes and benefits that people obtain from the information society. Thus, the effect of unconscious literacy in digital inclusion is more associated with the familiarization with digital tools and the acquisition of confidence and awareness of their potentialities rather than with learning a certain set of digital skills. The most important competency is the confidence in the possibility of acquiring new digital skills if needed, rather than just the knowledge of a limited set of tasks. This confidence is acquired during long-term processes of familiarization and domestication of technologies—even if they appeared as "wasting" time online, as Robinson (2009) remarked, so digital inclusion policies should take into account the importance of promoting the use of a wider variety of digital devices, even experimenting and investigating new forms of appropriation to particular goals, instead of just teaching a formal set of digital competencies. A good example of this confidence is presented below, in which a respondent admits the importance of his past digital experience during later stages of life:

> I started downloading when Edonkey appeared, and after Emule, Napster and so on, more than fifteen years ago. You had to stay for three or four days to download a film, but you learned a lot about the Internet. I was an early adopter, in this sense. This experience of cracking [installing software without a license] and seeking on the Internet helped me a lot afterward. (Man, b. 1984)

Regarding socio-demographic inequalities among our respondents, the main gender inequalities in terms of unconscious literacy are linked to the longer biographical experience of socialization in the use of digital devices by men, in comparison to women. If this gap is not compensated by alternative forms of literacy (such as professional literacy), the knowledge gap between men and women can become even wider in subjects' future life stages. In terms of generational location, literacy associated with mobile devices (smartphones, tablets, etc.) is predominant, whilst among people between ages 23 and 29, literacy associated with a personal computers is more common, which could serve as an informational advantage in terms of productive forms of use. Among older respondents, literacy trajectories are much more discontinued, and the gap between pro-technology users and people disinterested in the digital world is much wider. Finally, at the educational level, unconscious literacy is more diverse and extended among subjects who went to university; they developed new forms of domestication of technology after adolescence which could lead to the acquisition of a very diverse technological habitus.

4.2. Self-Motivated Literacy

> For me, it was never difficult to learn how to use computers; they are quite intuitive. You almost learn by trying, by trial and error, almost crashing the computer, rebooting it and so on. And when I have had a problem or doubt I just needed to look on the Internet, on Google, where you can find everything. (Man, b. 1988)

Besides unconscious literacy, another form of individualized digital literacy is self-motivated literacy, which emerges when people need to fulfill a certain task, but they lack the specific digital competencies to do it, so they voluntarily invest effort and time to acquire the knowledge needed. As remarked in the quote above, self-motivated literacy is much more common among young people who are familiarized with the use of digital technologies and confident in their potential to acquire new digital skills. Therefore, this kind of literacy is extremely interwoven with pro-technology attitudes and personal interest in the digital world. As a consequence, people who are not confident in their digital competencies or who don't have an interest in digital technologies are in a worse position in terms of taking advantage of the possibilities of the digital realm. They usually don't trust their capacity to learn new skills, which is influenced by their low interest in exploring new features and options of digital devices. Also, in terms of digital inclusion, it is important to remark that motivated literacy, because of its limited temporal focus and high level of formality, is more useful to acquire particular digital competencies needed to fulfill distinctive tasks rather than to internalize general dispositions, familiarity, and confidence in the use of digital technologies. Consequently, formative policies might have a limited effect on digital inclusion if their focus is generally on a specific set of skills—top-down digital literacy—rather than in generating interests and encouraging people to explore and experiment with technology. In the next quote, we reproduce a case of strong motivation towards digital devices, remarked by the necessity of becoming "autonomous" and "self-taught":

> In the beginning, there weren't even forums or tutorials, so you had to learn by yourself or ask friends….After forums and other web pages dedicated to specific issues appeared, so information became wider and more independent from offline relationships; you could directly become autonomous and self-taught when you had to learn how to do things. (Man, b. 1984)

Nonetheless, it is important to highlight that self-motivated literacy could also appear among users who aren't familiar with the use of digital devices. In such cases, respondents aren't interested in digital technologies, but they feel the need to use them, becoming frustrated and hopeless because they think that a huge investment of time and effort is needed to get familiarized with ICTs. Also, it is quite common to turn into their social circle—see Section 4.4—and delegate such digital practices, but when this is impossible, they need to seek online tutorials or formative courses. Thus, formal training courses are much more common among respondents who are unfamiliar or disinterested in digital technologies. Despite this, in our sample, individualized forms of motivated literacy (online guides, tutorials, etc.) are mentioned much more frequently than formal courses or training, which seems to be quite infrequent among young people. A case of this necessity of using digital tools combined with a lack of confidence and interest is reproduced below:

> I bought a computer three days ago, and I am bothered about having to learn how to use a new laptop, installing programs, I didn't even have Office yet, because buying it was very expensive and I don't know how to crack it….I have to ask my sister about everything because she is much more skilled than me….If I couldn't rely on her, I would be desperate, since I have no idea about computers. I had my laptop for three days and I still don't know what to do. (Woman, b. 1988)

Taking into account the socio-demographic profile of our sample, an important gender divide emerges, since young men are usually more interested in the use of digital devices—particularly computers—than women. This could engender new digital asymmetries because of the differential technological trajectories of men and women. Therefore, the gender gap is more related to the motivation and emotional costs (Huang et al., 2015) rather than specific digital skills, so digital inclusion poli-

cies should focus mainly on engendering subjects' confidence and interest in using digital technologies. In terms of generational location, a lack of interest towards the digital realm is more common among older respondents, although younger people are commonly more interested in the use of mobile devices in comparison to personal computers, which are more present among people between ages 23 and 29, a generation closely entangled with the use of computers since adolescence. This is logical, as older generations did not feel the need to use digital devices at all during their primary socialization, whilst younger respondents have been socialized in a much-diversified landscape of forms of accessibility. Finally, a higher educational level is also generally associated with pro-technology attitudes and higher interest in learning new digital skills; however, this is generally mediated by formal spaces of digital use, which we will develop in the next type (professional literacy).

4.3. Professional Literacy

> During school, I started to do reports and to use the Internet a little bit more. Afterward, during high-school, we have a specific subject about computing and we learned how to use PowerPoint and Excel. (Woman, b. 1990)

Professional literacy refers to the formally-structured social contexts in which agents interact during their technological socialization: mainly schools, universities, and the labor market, as remarked in the quote above. Some of these spaces are shared by most young people, such as schools, while others depend on their biographical trajectories, such as universities and work. Although school is one of the first spaces of contact with digital technologies after one's house, its incidence in subjects' techno-dispositions and digital skills is quite low: Respondents remarked that their interest in the digital world usually drifts towards friends and family rather than school, in which digital tools are mainly associated with basic office tasks and Internet information-seeking skills. Nevertheless, the case of universities and work is different, since these two social contexts appear as very important spaces of domestication of technology which allow people to compensate and complement their previous digital skills. In other words, personal use of digital tools during adolescence and childhood can be associated with a primary socialization process, whilst university and work can be conceptualized as secondary socialization instances, allowing those subjects who get to university, or who work in a position related to the use of ICTs, to increase their digital competencies. Below, we include two extracts of interviews in which the entanglement between digital technologies and work position is described:

> I work in a hotel, so everything is done by using a computer: sending and receiving emails, using the program to manage reservations, looking for the information requested by clients, such as tourist guides, tours, an address, or anything. Of course, everything is connected to the Internet, so if there is a problem with the connection we can't work. (Woman, b. 1995)

> Understanding the Internet as something connected with many different things, I use it mainly for access to information since my work is linked with data-analysis. I have to look for databases and other information sources, and of course, I have to use email as the principal communicative tool at the office. (Man, b. 1984)

In terms of digital inclusion, professional literacy is extremely important among subjects who haven't developed a long-term process of technological domestication during adolescence. As a secondary form of socialization, professional literacy allows people to develop new dispositions and attitudes towards the use of digital technologies. These new dispositions are not just formal digital skills but attitudes, expectations, and representations of the potential of digital technologies, which become particularly relevant when they are not confined to the specific formal tasks needed at university or in the labor market, but when they are transferred to new spaces of activity. In other words, people who were not interested in the digital world during adolescence—whose unconscious literacy was scarce and fragmented—can internalize new digital dispositions at work (and at university) and transfer them to other daily spaces of activity, increasing their confidence in the use of digital devices. For instance, in the next extract of the interview, we can realize how professional literacy can modify how people represent digital technologies and their relationship to them:

> I was hopeless with technology, I have always rejected computers and they were always hard for me. For example, learning how to use Excel was very difficult….On the one hand, I reject these tools, I am quite narrow-minded regarding them, I am not interested in learning because I am not enthusiastic about technology.…On the other hand, in the end, I was forced to learn because of work; at my job they love Excel and I thought: 'You will have to learn.' I looked for online guides, I asked colleagues for help and, step by step, I more or less managed to get along, since I didn't want to be a burden to them.…In the end, you discover it's not so complicated, you just need to invest time and little by little you learn how to deal with such tools. (Woman, b. 1991)

Consequently, there is an important gap between those subjects who went to university and those who did not, since the first ones have experienced a secondary process of domestication added to their previous digital practices, which could place them in a position of informational advantage—the same idea might apply

to those subjects who have worked on technologically-mediated posts. Also, professional literacy appears as an efficient way of reducing the gender digital divide, since this kind of familiarization with the use of computers at work and university is still more common among women, allowing them to reduce their confidence and emotional gaps (Huang et al., 2015) in comparison to men. Hence, formative policies should include these long-term forms of domestication of technology, oriented toward the familiarization with the use of ICTs after adolescence and, therefore, they should promote the emergence of social spaces in which the use of technology could motivate digitally excluded people.

4.4. Social Support

> I learned from my brother, since he had much knowledge about computers and liked that world. He was the one who told me: 'When this happens you have to do this.' Many of the tricks I know today are because of him; even if my skills are quite basic, at least I can get along with digital technologies. (Man, b. 1996)

The last form of digital literacy appeared during the interviews is social support, which can be conceptualized as an interpersonal link between two or more subjects in which digital knowledge is shared among the group, so people can take advantage not only of their own digital skills but also of their acquaintances. As highlighted in the quote above, the domestic space is, in many cases, the first space of sharing digital knowledge among family members, even before school, since it is at home where most of the respondents had their first contact with digital technologies. This situation generates an unequal space of possibilities since those subjects who were able to have access to digital devices since childhood and, more importantly, who had a connection to someone who could introduce them in the digital world, experience an informational advantage in terms of familiarization with ICTs. Therefore, the differential social resources are the main form of inequality associated with this form of literacy, but the possibility of taking advantage of such resources depends on other forms of literacy present in people's biographical processes of domestication of technology—particularly unconscious literacy. Hence, engendering social networks of support is a good policy in terms of digital inclusion, but it also requires a personal proactive attitude and motivation to incorporate such potential competencies and avoid just delegating digital practices. In the following extract of an interview, the interconnection between social support and personal motivation is clearly remarked:

> In the end, all the apps have options that you don't know how to use. If, for instance, I see someone doing something that I don't know, I ask them: 'Hey, how did you do that?' 'You have to press this arrow and this button.' Then you learn that, but just because you like the platform, if there is something you don't like, you will never learn how to use it. For example, this was my problem with Snapchat, I used to see everybody with dog ears or something but I don't like the app, so I have never had the interest to learn how to do it. (Woman, b. 1994)

Consequently, a crucial issue regarding social support is the ambivalent interconnection between personal motivation towards the use of ICTs and the possibility of delegating certain digital tasks to someone else. As clarified in the quote above, one will only learn how to use a certain tool if he/she is interested in it, so in the cases in which subjects are not motivated to learn how to do something, they will simply ask someone else to do it for them. Such proxy-delegated uses—someone else does the task instead of the subject—are ambivalent in terms of digital empowerment: On the one hand, people can complete tasks which are impossible individually; on the other hand, they do not learn how to complete such tasks, so they become less motivated to incorporate new competencies and their confidence in the use of digital tools is reduced. Consequently, social support cannot be directly transformed into higher digital inclusion, since this inclusion is generally achieved in terms of task resolution, that is, by bypassing the limits of one's internalized competencies through mobilizing social capital to take advantage of others' digital knowledge. In the quote reproduced below, we can find an example of this complete lack of interest in acquiring new digital skills and total digital dependence on the family:

> I use a platform recommended by my brother to watch movies online….I don't download anything because my brother does it for me. I am so bad with those things, it's very difficult to find a page to download movies with good quality….He also helps me if I have a problem with my computer, I know how to use some tools, especially for work, but for anything else, I depend on my brother. (Woman, b. 1982)

Finally, we need to consider the interconnection between social support obtained for using digital technologies and subjects' sociodemographic and cultural conditions. Among our respondents, we found that those subjects who have experienced a long-lasting process of familiarization with the use of digital technologies, particularly computers, since childhood and adolescence are less prone to delegate digital practices to their social ties. On the contrary, they usually act as expert mediators for others, aiding relatives and friends in fulfilling difficult digital tasks. Also, when they need support for a particular task, they are usually motivated to learn how to do it instead of just delegating it, so social support has a positive outcome among them. In terms of gender, in general, more men act as expert mediators for their social circle, although gender differences are nuanced among better-educated people and subjects who

usually work using computers and digital tools. In generational terms, proxy-delegated uses become much more common among older respondents, whilst younger ones are generally more interested in the digital world and use social support to increase their digital knowledge. Finally, in terms of education, it is clear that universities serve as a secondary form of technological socialization which engenders new interest among digital tools, so better-educated subjects are generally less dependent on delegated digital practices.

5. Discussion

In this article, we have focused on the connection between digital literacies and technological socialization. Broadly, we have developed two individual forms of literacy (unconscious and self-motivated literacy) and two socially-mediated forms of literacy (professional literacy and social support) to conceptualize the particularities of the mechanisms by which people incorporate digital tools into their ordinary practices. Unconscious literacy is present among all users, but those subjects who have experienced longer itineraries of familiarization with the use of ICTs since childhood are generally in a better position, in terms of digital inclusion, to take advantage of the potentialities of the digital world. As a consequence, self-motivated literacy is especially relevant among those subjects who are already familiar with the use of digital skills, investing time and effort to improve their skills and therefore increasing the gap among digitally excluded people. Also, socially-mediated forms of literacy are especially important among subjects who are disinterested in ICTs. In the case of professional literacy, the type of techno-dispositions and digital skills acquired are relevant because they can be transferred to other fields of activity, working as a secondary techno-socialization process which is added to previous individualized forms of literacy. In the case of social support, subjects can deploy digital tasks beyond their internalized digital skills.

Summing up, the main contribution of the article to digital inclusion research is the presentation of a comprehensive model of digital literacy and its connection with the biographical process of socialization in the use of technological devices. Therefore, teaching specific sets of digital skills (top-down literacy) is insufficient to promote digital inclusion, since such competencies vary often and usually it is more important to be confident and familiar with the use of digital devices (bottom-up literacy). Hence, building up social spaces of use of digital devices in which people feel motivated to explore and experiment with ICTs, exchanging knowledge with others, is crucial to becoming familiar with digital tools. In Bourdieu's terms, familiarization and confidence are internalized in the habitus through techno-dispositions (Straubhaar, 2012) which can engender new courses of digitally-mediated action, enabling the possibility of internalizing new digital skills in the natural process of incorporation of digital devices in life.

6. Conclusion

In this article, we have shown how digital inclusion cannot be reduced by just granting material access to digital equipment and tools—the first-level digital divide (Compaine, 2001)—or by increasing people's level of digital skills—the second-level digital divide, referring to forms of use (Hargittai, 2002; van Deursen & van Dijk, 2014). It is also necessary to generate a feasible environment of technological domestication in which people feel at ease in the use of digital technologies. Digital literacy cannot be achieved just by promoting intense spaces of learning structured sets of skills, since most of these competencies are acquired during long-term processes of domestication of digital devices (Silverstone, 1993). Consequently, digital inclusion policies should also aim to engender interests, motivations, and techno-dispositions (Rojas et al., 2012) among users, since the main barriers of digital performance are usually motivational (Reisdorf & Groselj, 2017) and emotional (Huang et al., 2015): Past bad experiences of use affect current digital practices, and people who are unfamiliar with digital devices become more and more excluded from the potential opportunities of the information society. Regarding this, certain sociodemographic asymmetries have been identified. By gender, men are usually more motivated and confident regarding digital devices, although these differences are more blurred in the case of younger and better-educated respondents. By age group, among older respondents, digital asymmetries are much wider, although in the case of younger respondents the variety of forms of technological domestication experience since childhood is wider. In the case of medium-age respondents, socialization linked to personal computers stands out. Finally, higher education is associated with better computer proficiency, particularly due to the effect of professional literacy associated with the university and the potential access to more digitalized jobs.

Moreover, the lack of a long-term biography of unconscious literacy associated with digital devices is one of the main factors of digital exclusion, even when material accessibility to such equipment is granted. In these cases, professional literacy is one of the main ways of promoting digital literacy, since it allows people to incorporate digital dispositions and become familiar with technological devices, rather than just learning a structured formal set of digital skills—like what many formative courses are oriented towards. Also, the effect of social support is ambivalent: It empowers already motivated subjects who mobilize their social networks to increase their digital knowledge, but it disempowers people who perceive a lack of confidence and ability to learn new skills and who are only interested in delegating difficult tasks rather than in learning how to complete them. This recalls the stratification theory (Lupač, 2018; Ragnedda, 2017), which the third-level digital divide theory is built on. This theory suggests that social inequalities are magnified in the digital realm by the differential outcomes

and benefits that people obtain from their distinctive appropriation of technology to increase their life chances. In conclusion, to promote digital inclusion, we need to focus less on top-down spaces of literacy—structured sets of skills—and more on generating bottom-up social spaces of digital practice in which people feel at ease (Sefton-Green et al., 2009). Thus, digital literacy policies should promote digitally mediated spaces of interaction in which people can become confident, familiar, and motivated towards the use of ICTs: This is the only way to incorporate strong techno-dispositions (Straubhaar, 2012) which could be used to learn new digital competencies under the diverse and mutable requirements of information society.

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Conflict of Interests

The author declares no conflict of interest.

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Article

Configuring the Older Non-User: Between Research, Policy and Practice of Digital Exclusion

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Abstract
Older adults face significant barriers when accessing the Internet. What can be done to address these barriers? This article analyses existing strategies to tackle the age-related digital divide on three different levels: research, policy and practice. It analyses (1) scientific conceptualisations that are used when studying Internet use and non-use in later life, (2) policies that address older adults' Internet (non-)use in Austria and (3) characteristics of older Austrian non-users of the Internet based on the Survey of Health, Ageing and Retirement in Europe (SHARE, wave 6). Analysis shows that Austrian policy tends to emphasise the individual responsibility to learn digital technologies, while placing a lower priority on structural issues, such as investments in infrastructure. However, SHARE data shows that only a small percentage of older non-users of the Internet is in fact reached with such interventions. Thus, this article suggests that policy needs to base its strategies on more refined understandings of Internet use and non-use in later life as well as a more nuanced image of the older non-user. A perspective of critical-cultural gerontology, as laid out in this article, highlights that technology adoption is a domestication process that takes place in the everyday lives of older adults, and it is these processes that interventions that tackle the age-related digital divide should take as a starting point.

Keywords
age; ageing; Austria; digital divide; digital exclusion; digital policies

Issue
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1. Introduction

Digital technologies, especially information and communication technologies (ICT) such as computers, smartphones or tablets permeate all aspects of our lives (Castells, 2010), older adults notwithstanding. While access to the Internet through these devices has become widespread across the globe, a gap between age groups persists (Hunsaker & Hargittai, 2018; Seifert & Rössel, 2019). In 2015, fewer than 10% of those aged 80 and older in the EU accessed the Internet, while 48% of Europeans aged 65–69 did so (König, Seifert, & Doh, 2018). However, while the first level of the digital divide—inequalities in access to the Internet—has been significantly reduced across Europe in the last decade, the second and third level of the age-related digital divide—inequalities in competence and performance—are still prevalent (Negreiro, 2015) and are much harder to grasp with political interventions. Digital inclusion, which comprises access, skills, attitudes and different levels of engagement with the Internet (Helsper, 2012), is therefore still unequally distributed across age groups.

Consequently, research in gerontology has put the question why older adults use or do not use the Internet on its agenda (Schulz et al., 2015). Early on, studies have highlighted the relevance of psychological factors, claiming that older adults are less likely to use the Internet because they show a higher prevalence of computer anxiety (Cattaneo, Malighetti, & Spinelli, 2016; Charness & Boot, 2009; Lee, Chen, & Hewitt, 2011; Neves, Amaro, & Fonseca, 2013; Silver, 2015), frustration with user interfaces (Damodaran, Olphert, & Phipps, 2013; Gatto & Tak, 2008; Hussain, Ross, & Bednar, 2017), negative attitudes toward technology (Kamin, Lang, & Beyer, 2017; Reisdorf & Groselj, 2017), and higher concerns about security issues on the Internet, mainly regarding personal information (Gatto & Tak, 2008; Hussain et al., 2017; Lee et al., 2011). Second, research has highlighted that older adults face health-related barriers when accessing digital technologies, arguing that access to the Internet is more challenging for those with, e.g., poor eyesight, shaky hands, or (mild) cognitive impairment (Charness & Boot, 2009; Cresci, Yarandi, & Morrell, 2010; Damodaran et al., 2013; Gatto & Tak, 2008; Hussain et al., 2017; Lee et al., 2011; Lelkes, 2013). Third, research has identified multiple socio-economic factors, mainly education and income, as predictors of older adults' Internet use. Low education and income (Charness & Boot, 2009; Cresci et al., 2010; Lelkes, 2013; Neves & Amaro, 2012), which impede and complicate access to devices, have been identified as main determinants of Internet use in later life (Bakaev, Ponomarev, & Prokhorova, 2008; Charness & Boot, 2009) and some studies even suggest that it is not age itself, but rather a combination of experience and level of education that determines the level of computer anxiety in later life (Fernández-Ardèvol & Ivan, 2015). This wide variety of influential factors highlights that it might not be age itself, but rather the social positions and resources of older adults that determine Internet use in later life. Further, Internet use in later life might also be a question of technological development and design, as research has noted that products are often poorly designed for older adults and therefore uncomfortable or at times even unmanageable to use (Charness & Boot, 2009; Czaja, Boot, Charness, & Rogers, 2019; Damodaran et al., 2013).

While research has identified multiple factors that explain why older adults use or do not use the Internet, interventions that support digital inclusion in later life have received less attention. For a long time, research on such interventions has focussed on online or face-to-face training courses as one strategy to support Internet use in later life (for empirical studies, see, e.g., Černá & Svobodová, 2018; Damodaran et al., 2013; Esteller-Curto & Escuder-Mollon, 2012; Fernández, Esteban, Conde, & Rodríguez-Lera, 2016; Kokol & Stiglic, 2011; Sitti & Nuntachompoo, 2013; Yamauchi, Yasuda, & Yokoi, 2008), making individual learning the most common strategy to prevent digital exclusion in older age.

Such individualized accounts of Internet use and non-use in later life, are, however, increasingly up for question. One of the more critical approaches towards the topic has been framed as a material praxeology of ageing with technologies (Wanka & Gallistl, 2018), which assumes that using or not using a certain technology in later life is not a result of an informed decision or an individual learning process, but influenced by variety of agents within a social field—individuals, institutions, discourses and technological devices—and the power relations between those agents. From this perspective, non-use of the Internet in later life is not an individual process, but "co-constituted in a social field, comprised of actors, discourses and power relations" (Wanka & Gallistl, 2018, p. 14): The way in which access to the Internet is supported by relatives and friends, the media discourses surrounding age and demographic change, the institutions which enable or restrain older adults' access to educational programs all might be involved in shaping Internet use and non-use in later life. To develop a more nuanced understanding of use and non-use of digital technologies in later life, hence, we need to take more than the older individual into account and instead ask which discourses in policy (and research) shape our understandings of Internet use and how these understandings relate to the everyday lives of older adults.

Taking such a perspective as a starting point, this article critically examines the political interventions that aim to support Internet use of older adults, asking: How is the use and non-use of digital technologies framed by policy? Which aspects of digital inclusion and exclusion are addressed by policies, and which ones are left out? And how do these framings relate to the actual characteristics of older non-users of the Internet? To do so, this article analyses existing strategies to tackle the age-related digital divide on three different levels. First, it takes a critical look at the concepts used when studying Internet use and non-use in later life, asking which policy implications derive from these concepts. Second, it analyses the three most influential Austrian policy papers on demographic change to explore which interventions are suggested to address the age-related digital divide and which assumptions on older non-users can be found in these papers. Finally, it juxtaposes these assumptions with Austrian data on older non-users of the Internet from the Survey of Health, Ageing and Retirement in Europe (SHARE, 2015) and asks how likely it is that the suggested interventions actually reach older non-users.

2. Conceptualising the Non-Use of Digital Technologies in Later Life: Critical and Cultural Perspectives

Which scientific concepts are used when studying Internet use and non-use in later life and which policy implications can be derived from these concepts? In gerontology, rational choice theories are most commonly used to explain Internet use and—more generally—technology use and non-use among older adults (Kolland, Wanka, & Gallistl, 2019). However, such approaches have been heavily criticised for reducing human behaviour

to economic models and underestimating the influence of socio-structural factors in later-life technology use (Künemund & Tanschus, 2014). In contrast to rational choice models, critical and cultural gerontology have highlighted the interconnection between the ageing experience in its socio-cultural contexts and the embeddedness of technology use in the everyday lives of older adults (see, e.g., Endter, 2016; Marshall & Katz, 2016; Neven & Peine, 2017). Internet use and non-use in later life is understood not so much a result of an informed and competent decision by a potential user, but a result of everyday practices, policies and discourses. Critical and cultural gerontology are concerned with this embeddedness in two ambivalent and often contradictory contexts: the everyday lives of older adults and the policy and media discourses surrounding them.

Analysing policy discourses surrounding ageing and technologies, critical scholars have shown how population ageing is often conceptualised as a societal crisis, whereas technological development is framed as its solution. This results in a triple-win rhetoric (Neven & Peine, 2017) surrounding technology use in later life. First, the care system can reduce costs; second, the economy finds a new market for growth; third, older adults themselves benefiting from technological solutions via a higher quality of life. This discourse, however, also puts older users of these technologies in a problematic position: While ageing is understood as an imminent crisis that must be 'solved' by technology, the non-use of digital technologies becomes a threat to this solution. A critical perspective on Internet use in later life, hence, requires questioning this problematisation and asking when, how, and for whom non-use might be problematic. Therefore, this perspective calls for interventions that "fit in with the lives of older people" (Neven & Peine, 2017, p. 13) rather than the logics of the ageing-and-innovation discourse.

This concern for poor compatibility between policy discourses and everyday lives of older adults leads directly to the other dimension highlighted by cultural and critical gerontology when conceptualising technology use and non-use in later life, namely its embeddedness in the everyday lives of older adults. Critical and cultural gerontology argues that the "rhythms and patterns that underlie the habitual and routinised everyday worlds" (Pilcher, Martin, & Williams, 2016, p. 678) of older adults are often overlooked in gerontological research. Hence, interventions need to investigate closely under which circumstances Internet use in later life is perceived as beneficial and under which circumstances it is not (Gallistl & Nimrod, 2019). Ethnographic studies have, e.g., shown how older adults who use medical alert bracelets consequently frame themselves as frail and vulnerable (Aceros, Pols, & Domènech, 2015), or highlighted how the incompetent use of the Internet by older adults might disrupt established hierarchies within families, where older men are often seen as techno-savvy grandfathers (Thalhammer & Schmidt-Hertha, 2015). Hence, interventions that tackle the age-related digital divide should be clearer in why, for what reasons and under which circumstances technologies can be beneficial for which groups of older adults and why technology use should be supported in later life.

As a consequence, a critical and cultural gerontological perspective puts the conceptualisation of non-use of the Internet as problematic into question. It also questions if use and non-use can be understood as binary variables per se. In 'real life,' there is arguably no such thing as a complete or absolute non-user of digital technologies. Instead, non-use is processual and fluid, with usage practices, non-usage practices as well as hybrid practices being constantly interwoven in the everyday lives of older adults (van Deursen & Helsper, 2015). Internet use and non-use is more complex than presumed by rational choice models, and the same holds true for older non-users. Studies that identify usage barriers of older adults toward new technologies often assume a homogenous group of older non-users (Reisdorf & Groselj, 2017) and rational choice models tend to reinforce this homogenisation by rationalising non-use through the lack of potentially positive outcomes and ease of use.

To summarise, the non-use of the Internet in later life is not (only) based on older adults' lack of motivation or skills, their health or social networks, but rather constituted in the complex interplay between policy and media discourses and the everyday lives of a heterogeneous group of older persons. Internet use and non-use in later life is constituted in complex social fields (Wanka & Gallistl, 2018) and successful interventions should therefore not only target older individuals themselves but also the policy discourses surrounding them. In the following empirical analysis, we hence raise two research questions:

(1) How is older adults' non-use of the Internet problematised in Austrian policies and which solutions are formulated to tackle the age-related digital divide?
(2) How likely are older non-users of the Internet reached by the interventions outlined in policy papers and which alternative solutions can be suggested?

3. Methods

This article aims to juxtapose Austria's policies on demographic change with everyday practices of older non-users of the Internet. To do so, it follows a mixed-method design that first analyses Austrian policy papers that target demographic change. The presented results are based on a review that was conducted in 2018. In this review, we identified the three most influential policy papers on demographic change in Austria and coded its contents (Table 1).

Second, we conducted an analysis of Austrian SHARE data to explore how likely older (65+ years) non-users of the Internet are to be reached by the interventions

Table 1. Austrian policy papers used for the analysis.

Publisher	Date	Title
Governing Parties ÖVP and FPÖ	2018–2019	*Government Program (2017–2022): "Together for Austria"*
Federal Ministry of Labour, Social Affairs, Health and Consumer Protection (BMASGK)	2016	*Guidelines for General Seniors' Development*
Federal Ministry of Teaching, Art and Culture (BMUKK), Federal Ministry of Science and Research (BMWF), Federal Ministry of Work, Social and Consumer Protection (BMASK), Federal Ministry of Economics, Family and Youth (BMWFJ)	2011	*LLL:2020 Strategy for Lifelong Learning*

outlined in policy papers. Non-use was measured as (1) never having used a computer and (2) not having used the Internet seven days before the survey. SHARE is a cross-national panel database drawn from different European countries, with information on participants aged 50 or older (Börsch-Supan et al., 2013). The present study used data about Austrian respondents aged 65 or older (N = 2,333) from wave 6 (version 6.1.0; see Börsch-Supan, 2018), which was collected in 2015.

We employed a binary logistic regression to determine the predictors of being a non-user (not having used the Internet and never having used a computer) using several socio-economic factors—age, gender, income, education, subjective health, activities of daily living, level of urbanisation—as independent variables. Next, a cluster analysis was used to explain the group-specific heterogeneity of older non-users of the Internet; two-step cluster analysis with log likelihood was used as the distance measure and the Bayesian information criterion as the cluster criterion. Several variables were considered to characterise respondents' everyday-life situations in the cluster analysis, including age, gender, level of education, the ability to make ends meet financially, level of urbanisation, self-perceived health, activities of daily living and leisure activities. The final step evaluated group differences between the four clusters regarding leisure activities and attitudes toward technology—specifically openness, knowledge and interest. The technology-related attitudes were collected in an Austria-specific drop-off questionnaire (SHARE, 2015) that asked questions about openness ("I am open to this"), knowledge ("I don't know about this") and interest ("I'm not interested in this") toward eleven different technical devices, including tablets, smartphones, fitness trackers, auto fall alerts and body fat monitors. If participants were not open toward these technologies, they were designated within the "not open" group, whereas those who were open toward one or more of the eleven devices were designated as belonging to the "open" group. The same procedure was followed for knowledge and interest. Finally, leisure activities (participating in educational courses) were included to explore differences between clusters. Significance was tested using chi-square (leisure activities) and one-way ANOVA (attitudes toward technology).

4. Results

4.1. Policy Analysis: How Is Older Adults' Non-Use of the Internet Problematised in Austrian Policies?

Like many European countries, Austria has experienced a demographic transition since the 1960s (Statistic Austria, 2015). However, this was not necessarily mirrored in Austrian policies, which have scarcely dealt with the consequences of demographic change outside of discussions on pensions and care. Given that demographic change is a negligible topic in Austrian policies, policies on Internet use, digital inclusion and demographic change seldomly overlap.

Generally, three major policy papers inform Austria's policies on demographic change, none of them thoroughly addressing the topic of Internet use (Table 1). The most important one is the Austrian government program (2017–2022), which discusses Austria's older population and demographic change under the umbrella topic of pensions, with the clear goal of keeping pensions stable for future generations. Outside of pensions and care, Austria's older population is not mentioned in the program. Topics surrounding Internet use are mostly elaborated on in the government program (under the umbrella term 'digitalisation'), however, not in relation to demographic change. A second key policy paper that informs Austrian policies on demographic change is the *Guidelines for General Seniors' Development*, which is based on §19 of the Federal Seniors Citizens Act. As in all analysed policy papers, quality of life is defined as the most important political goal for the older population in Austria. This general goal should be accomplished through activities described in fourteen different sections (e.g., social and political participation, education and lifelong learning). Internet use of older adults is named as a marginal point within the "Housing Conditions, Technology and Mobility" as well as "Education and Lifelong Learning" sections. Here, the guidelines highlight the most important interven-

tion to increase the quality of life of older adults, which are learning, education, and guidance services in different areas:

> Conducting training courses and digital media courses; conducting language courses, courses in memory training and similar activities; carrying out of activities, specially designed to preserve everyday life skills. (BMASGK, 2016, p. 5)

Therefore, lifelong learning (e.g., through regular courses or training programs) is outlined as the most important intervention to tackle the age-related digital divide. This is mirrored in the third key policy paper that informs policies on demographic change in Austria, *LLL:2020 Strategy for Lifelong Learning* (henceforth simply called the LLL:2020). The strategy aims to gradually increase retired adults' participation in learning programs during retirement to at least 12%. Several interventions are specifically named to reach this goal, e.g., nation-wide and professional learning and guidance services. However, the LLL:2020 strategy also acknowledges that older adults' access to learning programs is marginal in Austria:

> A nationwide program as well as educational counselling for older adults is hardly available. Data on educational participation in retirement is scarce. (BMUKK, BMWF, BMASK, & BMWFJ, 2011, p. 42)

What main conclusions can be drawn from these policy papers? First, they show that the quality of life in older citizens is the main objective of national policies that target older people. Access to the Internet is mentioned as a topic; however, this is only a secondary goal of policies for older adults in Austria. Because of the strong focus on supporting quality of life, digital inclusion often plays a small role in the analysed policy papers. When Internet use and demographic change are brought together in Austria's policy papers, it is under the umbrella policy of life-long learning, e.g., in the LLL:2020. This policy paper names several strategies for how the use of the Internet in later life can be supported. Education, life-long learning, as well as guidance services are named as the most important interventions. Hence, if the digital inclusion of older adults is mentioned as a topic in Austrian policy papers, individual learning is often named as the only strategy to solve the challenges connected to the digital divide, framing digital inclusion as a problem that can be fixed through individual motivation and learning by older adults themselves—rather than a structural challenge.

4.2. Analysis of Practice: How Likely Are Older Non-Users of the Internet Reached By The Suggested Interventions?

Policy analysis showed that learning and training programs are the most common intervention suggested to support Internet use in later life. How likely are older non-users of the Internet reached by these interventions? In the Austrian SHARE sample, 46.1% (n = 1,029) of the respondents (65+) had neither ever used a computer in their lives nor the Internet in the last seven days, which, for the purpose of this article, lets them fall under the definition of 'non-users.' In line with previous research (Hale, Cotten, Drentea, & Goldner, 2010; Helsper, 2010; Seifert & Schelling, 2016; Wangberg et al., 2008), data shows the oldest-old, women, those with lower educational status, those with lower subjective health and those who lived in rural areas were most likely to fall under the definition of non-users of the Internet (see Table 2).

This high percentage (46.1%) of older non-users of the Internet in Austria calls for a more differentiated view on which types of non-users exist. A two-step cluster analysis using socio-demographic variables, health, and urbanisation levels identified four distinct clusters of older non-users of the Internet: younger non-users, male non-users, urban non-users, and non-users with health limitations (see Table 3). The first group, "younger non-users," were mainly characterised by their age, which was significantly lower than in the other clusters. Consequently, they were generally in better health. Further, this group was characterized by living in mostly rural environments, with 74% living in rural areas. The second group was labelled "male non-users," because

Table 2. Binary logistic regression of the predictors of Internet use/non-use.

Predictors	Odds ratio	Standard error
Age	1.11***	0.009
Female	1.56***	0.111
Making ends meet	0.90	0.071
Education (reference: high)		
Low	9.27***	0.166
Moderate	2.45***	0.138
Subjective health	0.81**	0.064
Activities of daily living	1.28	0.180
Rural area (reference: urban)	2.23***	0.110

Notes: *p < 0.05; **p < 0.01; *** p < 0.001; Nagelkerke's r^2 = .380; x^2 (8) = 680.65, p < .001; N = 2,037. Non-use was measured as (1) never having used a computer and (2) not having used the Internet seven days before the survey.

Table 3. Characteristics of the cluster groups (%).

	Non-users				
Characteristics	Younger	Male	Urban	With health limitations	Total
Age (mean (SD))	70.1 (3.35)	76.5 (7.11)	76.9 (6.78)	81.7 (5.88)	76.8 (7.30)
Gender					
Male	9.5	100.0	24.0	4.2	33.7
Female	90.5	n/a	76.0	95.8	66.3
Education					
Low (0–2)	69.0	29.4	12.5	75.0	48.3
Moderate (3–4)	24.5	56.3	64.4	20.1	40.0
High (5–6)	6.5	14.3	23.1	4.9	11.7
Make ends meet					
With difficulty	22.0	11.3	12.5	24.7	18.0
Fairly easily	26.0	30.7	33.7	35.4	31.8
Easily	52.0	58.0	53.8	39.9	50.2
Subjective health					
Very good	27.0	16.0	28.4	3.1	17.2
Good	36.0	21.6	57.7	22.9	33.2
Fair/poor	37.0	62.3	13.9	74.0	49.6
Activities of daily living					
No limitation	97.5	80.1	99.5	51.4	79.3
At least one limitation	2.5	19.9	0.5	48.6	20.7
Place of Residence					
Large cities and suburbs	13.0	14.7	72.6	20.1	29.0
Small towns	12.5	8.2	26.4	9.0	13.5
Rural areas	74.5	77.1	1.0	70.8	57.5
Total (%)	21.6	24.9	22.4	31.1	100

they consisted solely of males, of whom 77% lived in rural areas. In contrast to the first group, they reported more health limitations. Notably, this was also the group that reported the highest financial resources, with 58% of this group reporting they could easily make ends meet financially. The third group was labelled as "urban non-users" because they had the highest percentage of adults living in urban environments of all clusters. This group also reported the highest socio-economic resources, with 23% reporting a high level of education. Consequently, they also reported high subjective health and only few health limitations. Finally, the last group was labelled as "non-users with health limitations," a group which consisted almost exclusively (96%) of women. This group was also the oldest in the sample of non-users and had the highest level of health limitations. They also had the lowest levels of education and had more difficulties making ends meet than persons in the other three clusters.

How likely is it that these diverse clusters of older non-users of the Internet are reached by the policy interventions outlined above? As Table 4 shows, it is mostly younger as well as urban non-users that are reached by educational courses, with five to 6% of the groups being active in educational programs in the 12 months preceding the survey. In contrast, male non-users and non-users with health limitations are less active in this context. Table 4 also shows that urban non-users were open to technology and had knowledge of devices but were not interested in using them; indicating a conscious decision to not use the Internet. Conversely, male non-users

Table 4. Group-specific activities and attitudes toward technology (%).

	Users	Non-users			
Characteristics		Younger	Male	Urban	With health limitations
Leisure activities					
Educational courses*	12.3	4.6	1.5	6.0	0.8
Attitudes toward technology					
Openness*	79.6	64.1	49.3	67.9	58.5
No knowledge*	25.8	39.6	37.1	27.8	52.2
No interest*	80.6	75.0	76.1	87.7	66.2

Notes: * $p < 0.001$. Significance was tested using chi-square (leisure activities) and one-way ANOVA (attitudes toward technology).

and non-users with health limitations were less open toward technology. Compared to all other groups, male non-users were the least open toward technology, even though they had a similar knowledge of technologies as younger non-users. Non-users with health limitations had the least knowledge about diverse technical devices. However, non-users with health limitations had the highest interest.

5. Conclusion

This article analyses existing strategies to tackle the age-related digital divide on three different levels: research, policy, and practice. Even though the data is inevitably restricted to the national context of Austria, it highlights three major results.

First, SHARE data analysis showed that older non-users of the Internet are far from being a homogenous group. Almost half of all respondents (46%) over the age of 65 reported never having used a computer and not using the Internet. Therefore, interventions to support Internet use in later life need to take the heterogeneity of older non-users of the Internet into account. The study identified four different clusters of older non-users of the Internet: younger non-users, male non-users, urban non-users and non-users with health limitations. Also, regression analysis showed that level of education, level of urbanization and gender were stronger determinants of Internet use than age and health. This result strengthens literature suggesting that the age-related digital divide is not determined by age, but rather low education and level of experience with digital technologies (Fernández-Ardèvol & Ivan, 2015). Given that age was not the determining variable in our regression models it might therefore be possible that our clusters solution might also be applicable for younger adults. Future research should examine this relationship between diverse clusters of non-users of the Internet more closely to understand if clusters of non-users are specific for the older age-group or not.

Second, analysis showed that while learning and educational programs might be one successful strategy to support older adults' Internet use, these interventions are likely to reach only a small percentage of older non-users. While younger and urban non-users were likely to be reached by educational programs, non-users with health limitations and male non-users showed hardly any participation in learning activities. This finding strengthens research that explores the selectivity in later-life learning (see, e.g., Gallistl, Wanka, & Kolland, 2018): Those who have benefited from education and learning over their entire life course are more likely to participate in learning programs later in life. Existing interventions that try to tackle the age-related digital divide therefore run the risk of reaching only those already in a more privileged position and leaving those older adults with the lowest resources behind. Hence, these findings add to literature suggesting that current interventions to support Internet use in later life tend to marginalise the realities of older adults that are less-well off (Sawchuk & Lafontaine, 2015) and calls for more diversity in strategies to support Internet use in later life.

Third, SHARE data showed that older non-users of the Internet are not only diverse in their socio-economic status, but also in their attitudes and openness toward new technologies in general. Male non-users of the Internet reported significantly less openness toward new technologies. This result is in line with other studies that highlight how technology use in later life is a gendered experience (Helsper, 2010; Pelizäus-Hoffmeister, 2013) and how older males in particular might feel personally threatened by the non-use of digital technologies, as it might disrupts existing hierarchies within families (Thalhammer & Schmidt-Hertha, 2015). It might also suggest that non-use of the Internet in later life is not only a result of certain barriers that restrict access, but also an expression of a specific taste orientation (Bourdieu, 1979/2013) or attitudes in later life.

Fourth, however, policies on demographic change in Austria seldomly take the outlined heterogeneity of older non-users of the Internet into account. In the analysed policy papers, supporting the Internet use of older adults remains a marginal topic and life-long learning is outlined as the most important one-size-fits-all solution. The older non-user, consequently, is framed as an agentic older adult that can be reached by educational programs. This is somewhat problematic as our study shows that only a very small percentage of older adults can actually be reached by life-long learning. Policies therefore tend to focus on low education as a barrier toward the Internet, while putting other issues (e.g., problematic discourses that marginalise the older population or issues around mobility) into the background. This contributes to the notion that the problem lies at an individual level, while overlooking other factors such as technology design for older adults (Neven & Peine, 2017).

Which conclusions can be drawn from these results? First, results show that research needs a more complex understanding of Internet (non-)use in later life than what contemporary theories in the field usually offer: Using or not using a certain technology in later life is not a result of an individual and informed decision, but interwoven with policy discourses and institutions surrounding demographic and technological change, as well as the everyday-lives of older adults. A perspective of critical-cultural gerontology, as laid out in this article, points to the fact that technology use and non-use is not a binary variable, but that technology adoption is a domestication process (Silverstone, Hirsch, & Morley, 1999) which describes the ways in which technologies become incorporated into the everyday lives of users through manifold, ambivalent and often contradictory social processes.

Accordingly, this article highlights the need to design interventions and support strategies to ease older adults' access to the Internet that "fit in with the lives of older people" (Neven & Peine, 2017, p. 13) rather than

the assumptions of research and policy. Such more complex understandings of Internet use in later life are, however, missing in Austria's policies on the topic. Hence, our results suggest that policy needs to base its strategies on more refined understandings of technology non-use in later life as well as a more nuanced image of the older non-user in general. Using or not using the Internet in later life is shaped by a variety of variables, including socio-economic status and individual motivation, but also experience with learning over the life course and older adults' diverse taste orientations, attitudes and interests. It is exactly these processes of domestication, and its surrounding discourses in policy and technological development that interventions used to address the age-related digital divide must take as a point of departure (Sawchuk & Lafontaine, 2015).

Which alternative interventions need to be thought of to support Internet use in later life? Applying these findings to the development of interventions suggests designing diverse interventions for diverse older target groups. One important division might lie between those who cannot and those who do not want to use digital technologies in later life, which might also call for different approaches when trying to reach these target groups. It also suggests that gerontology should not only put the non-use of digital technologies on its research agenda, but also technology reluctance, resistance, neglect, or taste and that policies should take these constructs more closely into account when designing interventions.

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Conflict of Interests

The authors declare no conflict of interests.

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Article

Digital Inclusion Across the Americas and the Caribbean

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Abstract
This research brings together scholarship across the Americas and Caribbean to examine digital inclusion initiatives in the following countries: Uruguay, Chile, Peru, Brazil, Mexico, Cuba, Jamaica, the United States, and Canada. Across the cases, several themes emerge that offer important indicators for future digital inclusion initiatives. First, public policy can effectively reduce access gaps when it addresses the trifecta of network, device, and skill provision. Second, this triple-crown of public policy is highly effective for longitudinal effect when implemented early via educational institutions. Third, rural-urban digital inequality is resistant to change such that rural populations benefit less from policy initiatives than their urban counterparts. Fourth, digital inclusion in rural areas and among marginalized populations is most effective when co-created with communities to ensure community investment, participation, and control. Fifth, stay-at-home orders during the COVID-19 pandemic are rapidly increasing our dependence on digital technologies, making digital inclusion more important than ever for education and rural communities. We therefore close the article with discussion of how the COVID-19 pandemic is amplifying digital disadvantage and exclusion across the Americas, the Caribbean, and the globe.

Keywords
Caribbean; COVID-19; digital divide; digital inclusion; digital inequalities; Latin America; North America; pandemic

Issue
This article is part of the issue “Digital Inclusion Across the Globe: What Is Being Done to Tackle Digital Inequities?” edited by Bianca C. Reisdorf (University of North Carolina at Charlotte, USA) and Colin Rhinesmith (Simmons University, USA).

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1. Introduction: Digital Inclusion across the Americas and Caribbean in Times of Pandemic

At the time of writing we are in the midst of the COVID-19 global pandemic. Due to lockdown measures across the globe, the pandemic is deepening the plight of the digitally under-resourced and excluded. In response to stay-at-home orders, the digitally resourced are moving their communications, work, healthcare, and relationships online. Yet the digitally disadvantaged must shelter in place without opportunities to maintain employment and income through telework from home or continue studies through e-education. They do not have access to digital social networks to mitigate physical and social isolation; they also lack access to digital information seeking for public health and telemedicine. The pandemic has thus brought to a head the need for digital inclusion for all.

To offer a panorama of key initiatives for digital inclusion, this research brings together digital inequality scholars from across the Americas and Caribbean. We take a comparative perspective to probe national initiatives from Uruguay, Chile, Peru, Brazil, Mexico, Cuba, Jamaica, the United States, and Canada. Across the national cases, several themes emerge. First, public policy can effectively reduce access gaps when it addresses the trifecta of network, device, and skill provision. Second, this triple-crown of public policy is also most effective over the long term when implemented early via education so that children "grow up digital" (Tapscott, 2008). Third, rural-urban digital inequality is resistant to change such that rural populations benefit less from policy initiatives than their urban counterparts. Fourth, digital inclusion in rural areas and among marginalized populations is most effective when co-created with communities to ensure community investment, participation, and control. Fifth, stay-at-home orders during the COVID-19 pandemic are rapidly increasing our dependence on digital technologies, making digital inclusion more important than ever for education and rural communities.

From these findings, we see the urgent need for short—and long-term digital inclusion strategies. To immediately respond to the pandemic, emergency policy measures should convert internet access into a subsidized public utility. In addition, other commercially driven policies (such as data caps) should be re-evaluated to decrease the burden of connectivity costs on marginalized populations. In addition to network access, policy measures must address device gaps, as well as skill inequalities through training and education.

Long-term, initiatives should focus on hard-to-reach, remote, and rural communities outside urban cores while meeting social, economic, and political needs. Researchers and policy makers seeking to meet digital needs must engage in initiatives that are co-created with communities to ensure that they develop and deliver digital resources in ways that respect their diversely situated contexts (McMahon, the First Mile Connectivity Consortium, & the Piikani Cultural and Digital Literacy Camp Project Team, 2020). If these kinds of endogenous development strategies are achieved, future digital inclusion strategies will not only meet material needs but also contribute to efforts to mitigate feelings of social and/or territorial isolation generated by insufficient access to digital resources and education.

2. Digital Inclusion in Uruguay

Uruguay is a small (176,000 km^2, 3.4 million inhabitants) and predominantly urban (95%) country (United Nations, 2019). Of the countries in South America, Uruguay has one of the lowest levels of income inequality and poverty but still lags compared to developed economies. Uruguay also has a high penetration of digital technologies, political stability, and welfare state development (Nathan, Pardo, & Cabella, 2016). This tradition of welfare provision is reflected in the country's digital inclusion strategy. Since the 2000s the government began to implement innovative policies on the national level to successfully reduce digital disparities. Two flagship initiatives stand out: Plan Ceibal and Plan Ibirapitá (Clastornik, Dornel, & Parra 2016).

Plan Ceibal was created in 2006 and counts as one of the most successful country-level "One Laptop Per Child" initiatives in the world. Ceibal's project was successful in great part because it was developed to be far more than just a program providing a laptop. It started as a 1-to-1 device provision initiative, allocating devices to all students and teachers in the public education system. Further, Ceibal also provided high-quality connectivity to schools, created an ecosystem of free educational software and contents, and distributed new pedagogical practices to complement them (Plan Ceibal, 2017).

Among several positive outcomes, Ceibal universalized PC and internet use through the Uruguayan Kids program that shrank differences in household PC access according to income and locality (Dodel, 2015; Dodel, Kweksilber, Aguirre, & Méndez, 2018). Moreover, by supplying computers to children and teachers, as well as providing free access to educational services and software, Ceibal's role has been critical during the COVID-19 quarantine to ensure the continuation of public and private education even under lockdown during which schools have shut down for 2020 (Plan Ceibal, 2020). However, as the enrollment in Ceibal's new pedagogy initiatives is non-compulsory, their effects depend on the teachers' willingness to adopt them, partially replicating pre-existing educational inequalities (Trucco & Espejo, 2013).

Plan Ibirapitá in many ways replicates the success of Ceibal among seniors. Ibirapitá was created in 2015 to promote digital inclusion among older adults (Plan Ibirapitá, 2017). Ibirapitá provided tablets with user-friendly front-end interfaces and services to socio-economically disadvantaged older adults. Ibirapitá also provided free workshops to learn how to operate the devices, thus reducing usage barriers related to skills. Providing both devices and skills training ensured the suc-

cess of the program by tackling the population's lack of digital experience (Sunkel & Ullmann, 2019).

While the Ibirapitá program did increase internet usage among older Uruguayans (Sunkel & Ullmann, 2019), the program's scope was limited to low SES pensioners. Unlike Ceibal, which was universally available, Ibirapitá focused only on a certain class of lower-income retirees. Neither non-retirees (many of whom are economically disadvantaged) nor older adults with higher incomes were beneficiaries of the program. There were two other challenges to the program's success, even within its target population (Plan Ibirapitá, 2017). First, retirees could only access the program's workshops at remote locations and delivery points. Second, the workshops could not address pre-existing levels of technophobia that may have precluded participation.

Nonetheless, even with their limitations, Ceibal, Ibirapitá, and complementary infrastructure policies were instrumental in expanding digital inclusion among Uruguayans. Along with digital policies relating to e-government and electronic health services (Clastornik et al., 2016), Uruguayan public policies have ensured higher levels of digital well-being among many. Finally, Ceibal and Ibirapitá have become solid pillars of the Uruguayan welfare state's digital inclusion policies during the 2020 pandemic. Their success has been further enhanced by policy measures to provide free home internet access with the removal of data caps during the COVID-19 quarantine.

3. Digital Inclusion in Chile

Chile has long-standing policies tackling digital inequality through expanding internet access and adoption (Kleine, 2013). Nationally, household internet access (either through fixed or mobile broadband) grew from 60.4% in 2012 to 87.4% in 2017 (Subsecretaría de Telecomunicaciones, 2019). The urban-rural gap has significantly decreased from 30.6% in 2012 (64.1% vs. 33.5%) to only 12.4% in 2017 (89.1% vs. 76.7%). Most of this growth has been driven by mobile broadband connections and smartphones. With 17 million inhabitants, Chile has a diverse geography: vast deserts in the north, islands, fjords, and rushing rivers in the south, and the Andes mountain range that stretches the length of the country. These geographic characteristics represent distinct obstacles to providing internet access infrastructure to rural areas. Even with these limitations, Chile has made notable strides in internet adoption, with a 63% rise in internet adoption between 2005 and 2016 (Figure 1).

Managed by the Undersecretary of Telecommunication, the Telecommunication Development Fund policy initiative addressed the urban-rural digital divide by expanding infrastructure in rural areas. Given Chile's geographical challenges, the fund incentivized the expansion of internet infrastructure to areas that were less financially attractive to telecommunication companies. The plan subsidized providers to connect isolated areas with low SES populations at or below the same cost as the nearest urban area. Although coverage could be provided through different forms of connectivity (including fixed, fiber-optic, or mobile broadband), the vast majority of the new connections relied on mobile-broadband infrastructure. Through the program "All Chile Connected," this fund has extended 3G/4G mobile connection to more than 2000 vulnerable areas since 2010. As a result, mobile internet connection and geographic coverage has significantly increased; the urban-rural gap has decreased in the past five years.

However, provision of infrastructure alone is insufficient. Despite the expansion of mobile internet coverage, skills gaps and lack of awareness remain challenges in remote villages. A face-to-face random survey in several isolated communities served by the Telecommunication

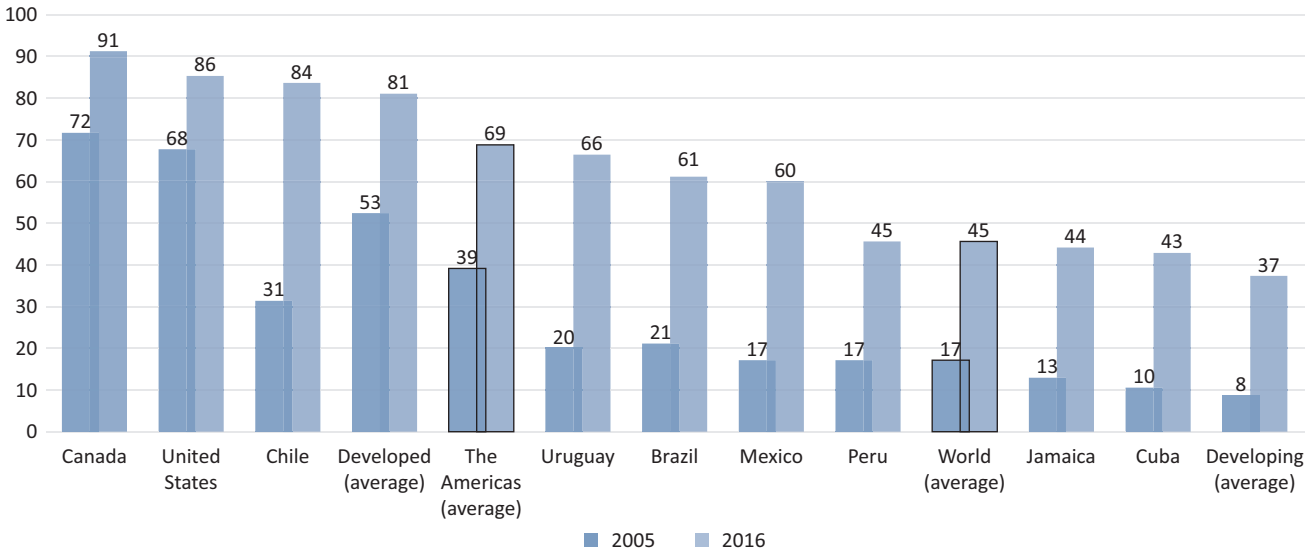


Figure 1. Individuals using the internet (percentages), 2005–2016. Assembled by author Matias Dodel with data from International Telecommunications Union (ITU, 2019a).

Development Fund revealed that only 37% of people used the internet (Correa, Pavez, & Contreras, 2017). This result is in line with findings in other Latin American countries where there is a gap between higher coverage and lower demand (Galperín, 2017). Findings revealed several causes for lower demand among rural populations, including insufficient awareness of opportunities and education regarding technologies' purpose. Further, lacking skills, residents were hesitant to bring unknown technologies into their close-knit communities. Insufficient skills training, as well as private or public outreach regarding potential benefits, undermined the potential success of infrastructure provision.

In addition, the strong policy emphasis on mobile coverage has led to a significant increase in mobile-only users, particularly through smartphones (Correa, Pavez, & Contreras, 2018). Although it represents an affordable and easier-to-use mode of access, mobile-only use is associated with lower levels of digital skills and fewer types of internet uses (Napoli & Obar, 2014). The limitations of mobile-only use on smartphones have been particularly evident in the era of COVID-19 among students. During the pandemic, those students required to connect online for their studies were at a distinct disadvantage when limited to connectivity via smartphones.

Therefore, despite the success of policies to increase coverage and expand infrastructure, additional work is needed to address the societal aspects of digital inclusion. More effective work can be done when government agencies join forces with the communities they serve and respond to communities' own assessment of their needs and particular contexts. Taken in this direction, future policy should seek to build infrastructure tailored to communities' needs and complement the infrastructure with skill learning and outreach.

4. Digital Inclusion in Peru

In Peru, rural populations are the most exposed to structural poverty for several long-standing reasons. Rural populations are less likely to enjoy economic opportunities, as well as access to education and health services. Due to their status as linguistic minorities speaking Indigenous languages instead of Spanish (the language used by the Peruvian state for its services), rural populations in Peru have also long been culturally marginalized.

Because of the difficult geographical terrain and the poverty of the rural population in Peru, market actors have not made investments to build the necessary infrastructure to serve populations with very limited purchasing power. The Peruvian government has therefore subsidized the building of infrastructure in difficult terrain where distances and conditions, from the high Andean plains to Amazonian river basins, pose substantial barriers and where the rural population cannot afford commercial services.

Using technological solutions to compensate for the absence of services is one of the tenets of ICTD thinking. Tackling the first hurdle of connectivity, Peru's Programa Nacional de Telecomunicaciones employed compensation and subsidy strategies with funds generated by commercial operators to provide connectivity to rural populations. One such initiative, the Rural Telecommunications Group (GTR in Spanish) carried out by Pontifical Catholic University of Peru (Telecom), in coordination with EHAS Foundation and Hispanic-American Linkage on Health, has accomplished a feat of engineering which makes possible connectivity under very complex and challenging conditions. This achievement has allowed many communities to connect to the internet for the specific purpose of providing e-health services. A variety of projects (Ludeña, Martínez, & Rendon, 2011; Rey-Moreno et al., 2011) were conducted from 1999 to 2014 under this umbrella. All the projects succeeded in providing connectivity sufficient to enable these services, even in very difficult terrain.

The infrastructure created by these initiatives had to supply not only basic internet connectivity, but also the capabilities necessary for data transmission involved in tele-diagnosis (including stethoscope, microscope, and sonogram data capture in situ) in remote locations. The telemedicine services enabled by this infrastructure allow local medical staff to carry out sophisticated medical interventions with the aid of collaboration with specialists located in other areas. This collaboration is possible because of the user-friendly telemedicine interfaces and low maintenance equipment which local healthcare staff can easily operate with training (Prieto-Egido, Simó-Reigadas, Liñán-Benítez, García-Giganto, & Martínez-Fernández, 2014).

These successes in the Peruvian context demonstrate technical feasibility and the capacity of the program to bring about desired institutional and societal outcomes that can improve people's lives in measurable ways. GTR projects, while successful in their immediate domain, could not surmount other overwhelming problems that impinge on quality of health services, which lie at the institutional domain (the lack of resources and absence of innovation in health provision at the local level for rural communities) and the societal domain (the actual adoption of best practices by the community being served). This can be attributed to disconnects between technological goals and social development goals, and the necessary connection between the two that institutional change has to produce.

The pandemic, which has led to lockdowns in Peru, makes solving these problems even more urgent and relevant and shows the importance of integrated approaches. Even when connectivity projects are successful, their usefulness for other purposes, like distance and virtual education, is not guaranteed without community buy-in and enhanced awareness of available resources. Under lockdown, telemedicine is not the only service which needs to be provided online. Distance education, for example, may be the one chance for Peruvian children to continue their schooling. These challenges require an inte-

grated approach comprised of provision of commercial access, efforts to raise awareness of resources, and community involvement to motivate the public to use digital resources—all in times of pandemic and beyond.

5. Digital Inclusion in Brazil

The Brazilian case serves as a compelling example of how policies aimed at promoting social solidarity and cohesion in the digital realm may prove insufficient when there is a gap between economic performance and digital inclusion. This divergence has led to the uneven insertion of Brazil into the global information society. While Brazil ranks in the top ten in terms of the size of its economy, in addition to constituting one of the main telecommunications and information technology markets in the Americas (ITU, 2018), it is also one of the top ten countries with the greatest level of economic inequality on the planet (United Nations Development Program, 2016). Roughly a quarter (26.5%) of its population currently lives below the official poverty line, according the Brazilian Institute of Geography and Statistics (2018). The inequality gap is especially apparent when we consider the fact that 44% of Brazilians who do not use the internet are from social classes D and E (the two lowest income categories).

Overall, sixty-seven percent of Brazilian households have access to the internet. However, internet access is not considered to be a public service in Brazil. The 2014 Brazilian Civil Rights Framework 'guarantees' internet access as a right and a vehicle through which to exercise citizenship. However, this formal guarantee is merely pro forma; in practice internet service is supplied by commercial operators who charge high fees. Due to service costs (Brazilian Internet Steering Committee, 2019), only 40% of economically disadvantaged Brazilians have internet service. Moreover, the device divide still pervades Brazilian society. While Brazilian households are more likely to have cell phones (93%), television sets (96%), and radios (62%), far fewer have a fixed landline telephone (24%), desktop computers (19%), laptop computers (27%), cable TV (25%), or tablets (14%) (ibid).

Despite these disparities, the Brazilian government has broadened access with a number of digital inclusion initiatives. These initiatives were institutionalized through publications and programs such as the *Green Book on the Information Society*, the Digital Cities Broadband Program, the National Broadband Program, and the Governance Digital Policy Program. Federal programs are based on the distributive model for access, training in the use of ICTs (digital literacy), network infrastructure improvements, free internet access provision in low-SES communities, satellite connectivity for schools and public services, and incentives for the development of free software and subsidized laptops and computers for teachers and students in public schools.

Like Peru and Chile, Brazil must confront challenging terrain that impedes the installation of infrastructure. Submarine cables and satellite coverage are necessary in regions where natural obstacles such as vegetation do not allow optical fiber and infrastructure expansion (ITU, 2018). To meet this need, Brazil has created successful programs providing satellite connections for public schools and tele-centers (public spaces offering free access to the internet) in underserved communities. The National Program of Educational Technology (PROINFO), created by the Ministry of Education in 1997, works with schools in both urban and rural areas to provide computers, digital resources, and educational content; the program is present in 50% of urban public schools, which also benefit from the School Broadband Program (da Silva, 2018).

The government's Citizens Electronics Service Program (GESAC) provides satellite coverage to 9,327 locations across the country where services through private operators are not available (personal interview, 2019). In 2017, GESAC provided connections to 649,579 students in 2,456 schools located in rural areas. In addition to GESAC, 6,673 youths were trained under the Rural Youth, Computers for Inclusion, and Citizenship Networks Programs. In sum, there are 3,452 municipalities with coverage of this type of network, comprising 62% of the total of Brazilian municipalities. By 2015, approximately twenty digital inclusion programs were subsidized by the state and managed by various ministries. However, deficiencies in the institutionalization of these policies and failure to maintain consistent dialogue have, in some cases, led to disconnects between government programs that threatened success.

In response to social isolation measures enacted to combat COVID-19, some measures have been adopted by the Brazilian government. The Ministry of Health has invested in public health initiatives via digital devices to inform the population about the disease, campaign for social distancing, and counter fake news related to contamination with applications such as "Coronavirus—SUS" (Ministry of Health, 2020). Further, policies have been enacted to ensure that operators expand access to telecommunications services during the pandemic, including increasing fixed broadband speed, providing Wi-Fi networks in public places, and extending deadlines for payment of services (National Telecommunications Agency, 2020). These measures brought on by the pandemic underscore the need for digital inclusion policies to meet social, educational, labor, and health needs.

6. Digital Inclusion in Mexico

Mexico as a case study sheds light on a market-driven national policy on telecommunications that does not target the needs of rural or remote populations. Mexican telecommunications policy is market driven and has focused on increasing competition, promoting investment, expanding broadband coverage, and increasing affordability (Rosas & Ovando, 2018). Networks and devices are provided as commercial services by transnational corporations in major cities and urban areas. In spite of sig-

nificant increases in the numbers of internet and mobile phone users between 2000 to 2016 (ITU, 2018), digital inclusion remains a challenge for those in rural or remote areas. In response, Indigenous communities and grassroots organizations in Mexico have stepped up to tackle the challenges of digital inclusion that national policy has not addressed and that market actors have neglected.

In 2013, the Constitutional Reform for Telecommunications opened the Mexican telecommunications sector to promote competition and affordability. Successful results included a price decline in the mobile sector, as well as price reductions in international long distance and mobile phone rates. There was also enormous sector growth: 141 new radio broadcasters, a third national TV chain, 33 new free-to-air local TV stations, and the release of the 700 MHz band to build a Shared Wholesale Network (SWN) providing 4G broadband access to at least 85% of the population of which 12.75% should live in areas with less than 10,000 inhabitants. (García Requena, 2018; Rosas & Ovando, 2018). According to the National Pool on Availability and Use of Information Technologies at Households, in 2018 only 40.6% of rural dwellers used the internet (compared to 73.1% of urban dwellers) despite the 2013 telecommunications reform and the creation and implementation of the SWN. Rural connectivity gaps are most prevalent in states with the greatest economic challenges such as Guerrero, Oaxaca and Chiapas (Instituto Nacional de Estadística, Geografía e Informática, 2018).

In this context, several communities, based on Indigenous organizational, economic and political systems have created, deployed, and maintained different telecommunications projects operating last-mile networks. Two examples are the community cellular networks in Oaxaca and community intranets. Community cellular networks operate in 14 communities in Oaxaca with coverage in 63 localities where 3500 users are served. Rhizomática created this model, giving rise to what Magallanes-Blanco and Rodriguez-Medina (2016) called the "technical program." Redes por la Diversidad, Equidad y Sustentabilidad A.C. (REDES A.C.) developed the "legal program." Such programs necessitated legal and technical skills for developing networks; their success set precedents that led to legislative reforms including augmented usage of the telecommunications spectrum for social benefit.

They offer a uniquely successful model such as the Telecomunicaciones Indígenas Comunitarias (TIC A.C.) in which the network's member communities provide "technical support, peer-to-peer support and maintenance of their networks. TIC A.C. is a fully licensed, social-Indigenous operator of cellular services" (Baca-Feldman, Bloom, Gómez, & Huerta, 2018, p. 179). Rather than top-down national policy, rural populations in Mexico rely on Indigenous communities' own initiatives. These networks are a semi-closed and local system of wireless nodes that provide access to locally hosted content. Beginning in 2017 Rhizomática (with the support of REDES A.C. and others) has developed a model of community intranets in four Mexican communities in the states of Chiapas, Nayarit and Oaxaca.

These projects are successful case studies of community-based projects addressing the connectivity gap in rural and remote areas. In times of crises, such as the devastation caused by the 2017 earthquakes in southern Mexico, Indigenous communities responded by producing and sharing digital resources such as podcasts that kept the population informed and attended to the needs of isolated and remote communities. Again, in response to the current COVID-19 pandemic, Indigenous peoples are translating vital information to Indigenous languages and sharing it through the community intranets. While their efforts are admirable and provide a model of success, they cannot be expected to wholly substitute for national policy. The COVID-19 pandemic has made this tension more evident as people in rural or remote areas face the challenges of an online response to the pandemic without adequate digital resources such as Indigenous students left out of online education who now risk losing an academic year or a college semester due to gaps in digital learning.

7. Digital Inclusion in Cuba

With a population of almost 12 million people, Cuba offers an important case study in three ways: first, the relevance of geopolitical contexts (in this case, the US-led embargo since 1962) to technology development; second, the contradictions inherent in expanding ICT access under an authoritarian regime resistant to challenges; and third, the contribution of state-led policies to the underutilization of the internet and other ICTs.

Cuba has an outdated infrastructure and low rates of internet penetration due to complex causes including state provision of networks and devices (historically in tandem with countries such as the USSR or Venezuela), as well as the US-led embargo and associated economic limitations. Between 1959 and 2018 there has only been a 7% increase in telephone penetration (3% to 10%). Even in 2008 when ETECSA was finally legally allowed to offer mobile devices, the rates were unaffordable. In 2016, Cuba still had low mobile internet penetration (2% of the population); of these, only 26% had smartphones (Sharma & Lucini, 2016). Public internet was accessible only in 2013, and further, was limited to 118 national "navigation points" with slow speeds and prohibitive costs (Bisset Álvarez, Grossi de Carvalho, & Vidotti, 2015; Elizalde & Lagarde, 2013). In addition, only 57% of the population self-identifies as internet users; just over 15% of households report internet access; and merely 99,000 people have registered broadband subscriptions (ITU, 2018).

These relatively low penetration rates stand in contrast to Cuba's provision of advanced technological training including degrees in Telecommunications Engineering (since 1985) and Computational Science (since 1991) offered by the Technological University of

Havana José Antonio Echeverría. Significantly, these educational policies support the nation's commitment to egalitarian education. However, despite having one of the highest literacy rates in Latin America, Cuba's technical training has not translated into equally strong levels of internet penetration or use.

This may lie in regulations on telecommunications. Regulations issued by the Ministry of Communications have limited infrastructure (Recio, 2013). Illustrative examples include: the Decree 209/96 (access to global computer networks will prioritize national interests, legal entities, and institutions of greater relevance to the country's development); the Resolution 90/00 (interconnection between national users will be carried out only through national means of transmission, which avoids the costs of international companies but also ensures mechanisms for monitoring content); and the Resolution 197/2013 (public internet access service "Nauta" will be implemented, operated with prepaid cards that prohibits uses of the internet that may be considered harmful to public security, economy or sovereignty).

Not surprisingly, these policies and related limitations on use have resulted in under-utilization of ICTS. Even key sectors, such as education, have limited access (3% of school sites), thus compromising long-term quality of the service and creating lag in processes of digitalization, computerization, and software development. The local, collaborative encyclopedia EcuRed, for example, did not attempt to link to Wikipedia or other global initiatives but to develop its own platform (Recio, 2013). The Bolsa de Permutas, which sought to stimulate barters, failed in part because of the poor web quality and the preference of Cubans for platforms outside Cuba that had to be illegally accessed.

Some argue that these limitations contribute to slowed techno-informational development that allows the government to continue to control society (Kelly, Cook, & Truong, 2012). Others argue that socio-political and economic changes are taking place in the country. However, they are not yet reflected in digital public spaces (Díaz Rodríguez & Sokooh Valle, 2013), and that continuing to limit infrastructure and freedom of expression will continue to provoke friction in light of Cuba's high levels of educational attainment.

Top-down digital inclusion policies (Medellín Torres, 2004) are in conflict with the potential of the internet to empower society. An example of this is the recent use of internet-based portals to question Cuban authorities regarding their reaction to the COVID-19 outbreak. According to Baró (2020), there were more than 6,000 comments on the official portal Cubadebate to request stricter measures, including the suspension of classes, ultimately decreed by the government. In sum, Cuba provides a provocative example of lag between the potential of a highly literate civil society and a government whose policies fluctuate between meeting people's demands and keeping them under control for political and ideological reasons.

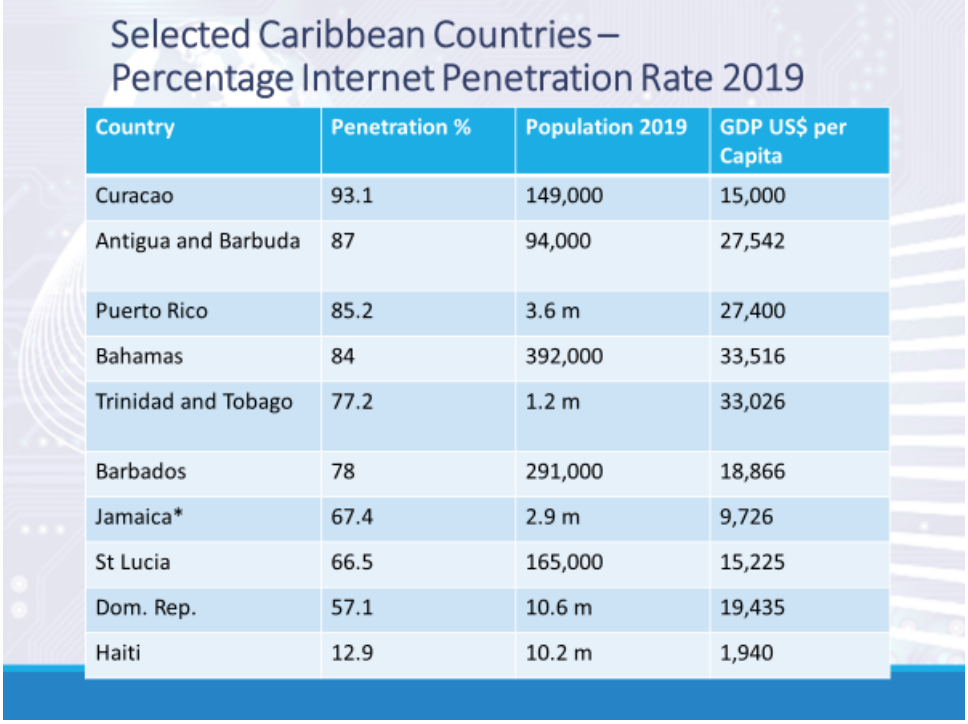
8. Digital Inclusion in Jamaica

Jamaica is the largest of the independent Anglophone Caribbean countries, with an estimated population of 2.9 million (World Bank, 2019). Liberalization of the telecommunication sector occurred in 1993 with policies developed by the Technology Ministry. Jamaica's strategic plan, ICT Vision 2030, articulates key benchmarks including expanded ICT infrastructure, steady development of human resources through systematic training, promotion of widespread information literacy in education and the general population, employment creation, and building of an enabling environment for ICT research and innovation.

Jamaica's 67.4% internet penetration ranked 7th in 2019 among other Caribbean countries (see Figure 2). However, a large proportion of this access was via mobile devices in a region with more mobile phone handsets than people. The country's small stock of internet-ready households remains a challenge. According to government data, Jamaica had a relatively low level of domestic 'postpaid' broadband subscriptions, amounting to 1.7 per 100 persons, compared to 2.95 per 100 persons in the wider Caribbean region in 2018 (Ministry of Science, Energy and Technology, 2018). These households with broadband access were predominantly in more affluent neighborhoods.

The performance of the ICT sector in Jamaica (67.4%) is better than or on par with global trends for similar developing countries. Figures from Internet World Stats for March 2020 indicated a world average internet penetration of 58.7%, where Africa, for example, was at 39.3% penetration. The access policies that have been pursued by the Jamaican government towards attaining its development goals include establishing community internet access points, free community Wi-Fi at designated hotspots, programs providing free laptop computers in schools, as well as dedicated formal training programs in ICT skills. Approximately 18% of persons enrolled in training programs at the government's HEART Trust National Training Agency, for example, were pursuing ICT related courses, including internet programming, web design, and computer repairs and maintenance (Jamaica Government, 2007).

Some of these community-based programs and government-driven measures to increase access were financed through a Universal Service Fund established in 2005. A levy was imposed by the Jamaican government on incoming overseas telephone calls to provide funds intended to support underserved local communities. Legal challenges by external providers to the legitimacy of the levy did not succeed, and Fund resources accumulated to significant levels that at times were under-utilized. The advent of free internet-based international calling has significantly reduced the annual income from the levy. At the same time, the available research indicates that some vulnerable population segments remained underserved in Jamaica's ICT coverage, including residents of



Selected Caribbean Countries – Percentage Internet Penetration Rate 2019

Country	Penetration %	Population 2019	GDP US$ per Capita
Curacao	93.1	149,000	15,000
Antigua and Barbuda	87	94,000	27,542
Puerto Rico	85.2	3.6 m	27,400
Bahamas	84	392,000	33,516
Trinidad and Tobago	77.2	1.2 m	33,026
Barbados	78	291,000	18,866
Jamaica*	67.4	2.9 m	9,726
St Lucia	66.5	165,000	15,225
Dom. Rep.	57.1	10.6 m	19,435
Haiti	12.9	10.2 m	1,940

Figure 2. Selected Caribbean countries: Percentage of internet penetration rates in 2019. Data from Dunn (2016), Internet World Stats (2020) and the ITU.

rural areas, residents in inner city communities, women business owners, and "unattached" youth (Dunn, 2016).

The advent of COVID-19 exposed the need for Caribbean countries like Jamaica to strengthen policies of social inclusion and effective access. Provisioning for disaster preparedness, emergencies, and environmental crises is to be found in the country's 2005 Natural Hazard Risk Reduction Policy and the more recent 2015 Disaster Risk Management Act. The country's Vision 2030 Development Plan also speaks to improving national disaster mitigation, decreasing risk vulnerabilities, and enhancing adaptation. Yet, these documents disclosed that there was little or no anticipation of a pervasive health crisis as posed in 2020 by COVID-19.

Internet access through mobile phones did not prove a suitable platform in the COVID-19 crisis. Administrations, as well as service providers, must move more swiftly to improve household internet penetration and public Wi-Fi access levels. For example, calls by government and university authorities asking for an urgent resort to online delivery of classes were not fulfilled. Schools collaborated more successfully with traditional media outlets such as radio and television to deliver classes to students at home. But even this more accessible mode of delivery did not prove suitable for some, given variable domestic circumstances and the need for some parents and caregivers to prioritize earning a living. Inadequate prior training of staff, wide variation in internet access by students, associated high costs, and often unsuitable domestic circumstances for such classes all pose significant challenges to digitizing education.

9. Digital Inclusion in the United States

The Silicon Valley in California is one of the last places on earth you would expect to find significant and persistent digital inequality; yet, nearly 100,000 residents of the City of San Jose lack meaningful internet access, as do nearly 25% of Californians overall (Levine, 2018). Looking at this epicenter tells us much about digital inequalities in locations with great wealth disparity, as is increasingly the case in California.

In the United States., home broadband adoption increased steadily from 2002 to 2010. In 2010 it plateaued at approximately 70%, and as of the most recent survey is at 73% (Pew Research Center for Internet & Technology, 2019). Further, when looking at digital inequality by income level, we see low-income households comprise the biggest portion of the disconnected. To date, efforts to address this gap have primarily involved third-party, community-based organizations attempting to identify and connect low-income households to existing, affordable offers and have yielded poor results (Hauge & Prieger, 2015; Manlove & Whitacre, 2019).

Economic data from a pilot project in San Diego provides an important understanding of the challenges. Of the respondents, 90.15% had an annual household income of less than $30,000, and 71.12% had an annual household income of less than $20,000. Combined, three different California projects with over 100,000 participants tested a number of out-reach methods to low-income households to raise awareness of existing, affordable offers, assist with obtaining free/low-cost devices,

and provide enrollment in free digital literacy classes. Of the three projects, the highest broadband adoption rate was 1.21%.

Cost is the biggest impediment to closing the gap, as we see with other cases such as Canada. Voluntary and/or community-based programs are not working. As such, mandated outreach and assistance policies and programs targeting low-income households should be implemented as they have been for electricity, telephony, natural gas, water, and other necessary utilities. These programs are overseen by the government entities and operated by the utilities. The programs have enrollment targets, require outreach efforts, and contain reporting requirements.

Also, like other cases, there is a second, completely different cause: the lack of infrastructure necessary to reach rural areas. According to the California Public Utilities Commission (CPUC) 2018 CASF Annual Report, 98.7% of non-rural California households have access to broadband infrastructure allowing service offerings of 10/1 Mbps, while only 71.5% of rural households have access to that infrastructure (CPUC, 2019). Because of the disparity in population bases, rural, disconnected households account for 4.78% of the gap (Levine, 2018).

Connecting rural areas requires laying many miles of cable to bridge the gap between the internet backbone and the rural communities. The trenching necessary—over great distances and often through very challenging terrain—is very expensive, and rural communities frequently lack sufficient end-user density, meaning that companies would likely never see the returns necessary to cover the cost of deployment. Here too, the power of government is necessary to address digital inequality. Investment from modern versions of the Rural Electrification Act, such as CASF and the Connect America Funds, are needed to make sure rural residents are afforded the same opportunities to reap the benefits of internet enabled technological benefits.

Further, the pandemic caused by the Coronavirus has brought into sharp focus the depth and profound consequences of these digital inequalities. Based upon early observations, the consequences of the pandemic have been most glaringly apparent in the efforts of school districts to change from traditional to distance learning as most schools and school districts in California have remained closed since 16 March. Without any concerted state-wide policy, public schools have floundered and been unable to provide equal access to digital learning, thus failing their mission to provide an education for all. Clearly, even in Silicon Valley and the rest of California, without government leadership and intervention, educational, as well as urban and rural digital inequalities will persist.

10. Digital Inclusion in Canada

In Canada, digital inequality persists in many rural communities, while users in urban and rural settings alike report prohibitive pricing and lack of appropriate digital literacy programming. The need for nation-wide affordable access and digital-skills initiatives has been confirmed from 2001 (National Broadband Task Force) to 2006 (Canadian Telecommunications Policy Review Panel) to 2018 (Auditor General of Canada).

In 2016 the national regulator, the Canadian Radio-Television and Telecommunications Commission (CRTC), established a new Basic Service Objective recommending speeds of 50Mbps download/10Mbps upload. This decision resulted from long-term advocacy by Indigenous and public interest groups in CRTC proceedings, including 2012 hearings on Northwestel's Modernization Plan and a 2014 inquiry on satellite services. The CRTC has also stepped in to re-regulate retail rates in Northern Regions that lack competition and announced a consumer-oriented internet code. Government has also set up several broadband funding programs managed by Innovation, Science and Economic Development Canada (ISED), the CRTC, and a forthcoming Universal Service Fund (ISED, 2019). These funds have already contributed to major projects including the Mackenzie Valley Fibre Link in the Northwest Territories, the Dempster Fibre Project in the Yukon, and funding for satellite infrastructure in Nunavut.

Nonetheless, additional public investments in broadband infrastructure and digital literacy initiatives in rural and Indigenous regions are needed. Community advocates have raised concerns about adequate infrastructure and services, as well as reliance on commercial providers rather than non-profit and cooperative organizations controlled by affected communities. Community advocates, many led by Indigenous peoples, continue to push for the co-development initiatives to address the specific contexts of user groups and promote local ownership and control of digital inclusion initiatives.

With respect to digital literacy, interventions should reflect the specific characteristics of user communities. Initiatives like the ISED funded Digital Literacy Exchange Program provided seed funding to deliver appropriate digital literacy initiatives to aid users to monitor speed and quality of service, ensure fair pricing practices, and protect against online risks. One example of such an effort combines digital literacy with efforts to document the rich cultural teachings of Elders from the Piikani Blackfoot Nation in southern Alberta (Jordan, 2018). In the Piikani Nation, a strong desire to document and share culture and language using ICTs is tempered by limited access, high-costs services, and concern over the negative impacts of adoption. Through an ongoing participatory action research project, Piikani Elders work with university-based researchers to collaboratively shape digital literacy workshops and learning resources that support their cultural revitalization goals. This approach stresses how important it is to learn from communities about how best to tailor digital literacy programming to mitigate risks and harness the potential of digital ICT.

It is important that digital inclusion efforts highlight the efforts of diverse user communities who have a long history of technology innovation (McMahon, Hudson, & Fabian, 2017). Countering the top-down approach of technology transfer, these communities have led local and regional networking initiatives since the early days of the internet (Carpenter, 2010; O'Donnell et al., 2016). This reflects a first-mile orientation towards endogenously driven telecommunications development (Paisley & Richardson, 1998) from Fort Severn's networks in Ontario to complex regional systems such as Tamaani Internet in Nunavik (First Mile Connectivity Consortium, 2018). The Kuhkenah Network began connecting communities in 1994 and has since scaled up to support regional networks and broadband-enabled applications such as e-health and online education. Such projects demonstrate infrastructure deployment in expensive-to-serve areas while retaining community ownership and control of networks, services, and applications. Their diversity illustrates a key point: Digital inclusion policy and programming must engage and reflect social practices that will drive effective use in a variety of community settings (Gurstein, 2012).

Discrepancies in access have been highlighted during the COVID-19 pandemic, as public services and businesses scramble to move online, putting increased strain on already-burdened networks in rural, remote, and Northern Regions of the country. In these regions, people are even more reliant on accessible, affordable connectivity services since many small villages lack brick-and-mortar health centers, schools, shops, and other organizations. Due to travel restrictions, the limited availability of local technicians constrains the ability of telecommunications companies to fix broken networks, which bolsters arguments to increase local ownership and capacity for community networks. Furthermore, as more people move their activities online, vulnerable groups are being increasingly targeted by online scams and misinformation, further highlighting the importance of digital literacy (Daigle, 2020). While some commercial providers are waiving fees at least temporarily (Northwestel, 2020), the policies of commercial internet service providers, such as the imposition of data caps, are exacerbated as more services and activities move online. For all of these reasons, the challenges of COVID-19 further underscore the urgency of meeting the needs of digitally marginalized groups.

11. Paths Forward

These case studies offer food for thought for future research and policy efforts. Nationally scaled digital inclusion programs are especially viable in smaller populations with higher levels of education, stable political environments, and governmental strata that work together. It is smaller populations where we have seen the greatest increases in internet adoption over the last 10 years (Figure 3). As the case of Uruguay demonstrates, digital inclusion policies succeed when they have backing from the executive branch, support from across the political spectrum, and integration of local stakeholders. They also succeed when they provide devices and access, as well as free and locally developed digital services and opportunities for skill development as exemplified by the Plan Ceibal and Plan Ibirapitá.

However, we also must add that a strong government is not always the answer. The Cuban case illustrates the shortcomings of top-down policies in a context of reduced freedom. The Cuban case offers important insight into the effects of limited freedom of speech and digital inclusion. The Cuban case also points to the need to think of digital inclusion beyond the legal frameworks and the formalities of regulations. While Cuba has been a pioneer in developing such frameworks, these regulations were implemented by an authoritarian regime such that ordinary people do not benefit from ICTs. Moreover,

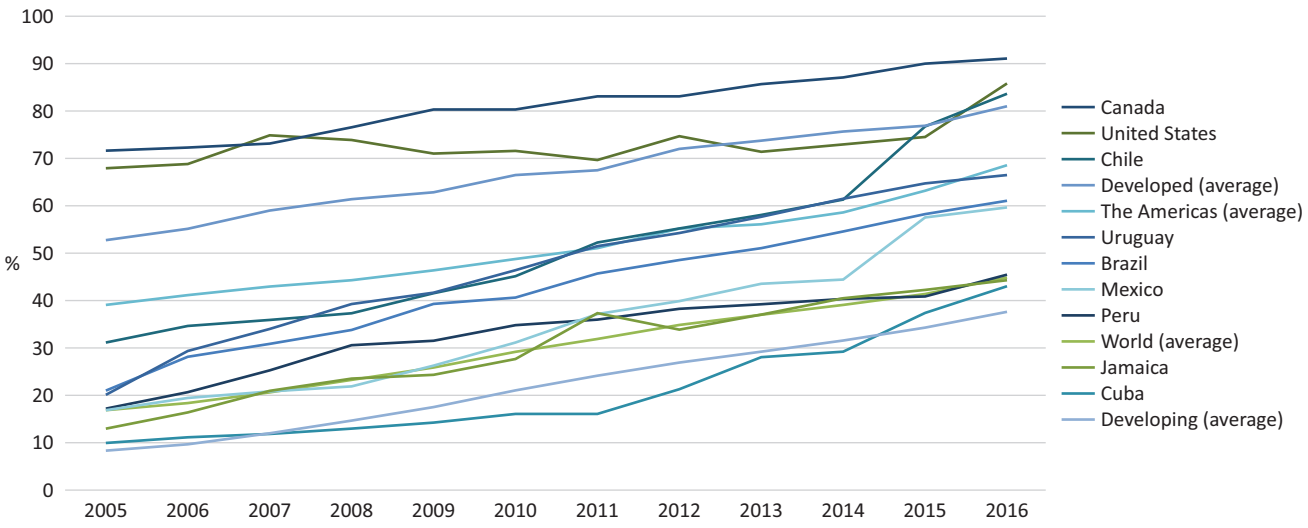


Figure 3. Individuals using the internet (percentages), 2005–2016. Assembled by author Matias Dodel with data from ITU (2019b).

Cuba underscores the connection between the absorption capacity of civil society (e.g., education) to receive new technologies that, intended or not, may challenge current trends in government and politics. Finally, the Cuban case shows that digital inclusion is connected to a society's capacity to appropriate technological developments, appropriation that is optimized when high levels of education provide opportunities to capitalize on the opportunities opened by ICTs.

In addition to public policy, stakeholders must have input. In Mexico, Brazil, and Canada, Indigenous and rural community groups have worked together to drive digital development initiatives in ways that meet their self-determined interests. Through a range of deployment initiatives, these groups are setting up and operating digital infrastructure, services, and applications. This work extends to recent efforts to develop and deliver appropriate digital literacy programs. Many of these projects adopt a non-profit or cooperative organization model, which enables community networking while addressing the challenges of market failure. In Canada, through national initiatives such as the First Mile Connectivity Consortium (www.FirstMile.ca) and in forums including the annual Indigenous Connectivity Summit, these groups are collaborating with like-minded organizations and individuals across the Americas (McMahon, 2020). With respect to digital inclusion policy development and the creation of culturally appropriate digital literacy resources, this kind of strong ethos of sharing and cooperation is central to the success of knowledge exchange across low-resourced environments. Finally, insights from the Canadian case are also present in programs in Mexico such as REDES A.C. and Rhizomática, which also reflect this approach and participated in the Indigenous Connectivity Summit (Magallanes-Blanco & Rodriguez-Medina, 2016) and Leal's work with Indigenous communities in the state of Roraíma in Brazil (Leal & Brant, 2012). Therefore, the pandemic underscores arguments to increase local ownership and capacity of community networks, particularly in rural and remote regions, and recognizes the essential role that Indigenous and non-profit telecom providers—as well as commercial service providers—play in these communities.

Future work must also consider digital inclusion as permeated by legal issues (e.g., patents, copyrights) and economic asymmetries (e.g., access to cutting-edge ICTs) given the great disparities in the development of technologies across different national cases. Scholars must also seek to identify links between different welfare state regimes and digital inclusion policy strategies (i.e., market driven, state founded, a combination) to see the potential for NGOs to provide solutions. Finally, future work must reveal the importance of supporting on-the-ground initiatives that are driven by locally situated groups, such as community networking initiatives and efforts to co-develop and share appropriate digital literacy resources. Often these initiatives are organized around a non-profit or cooperative model, which helps address the limitations of market-driven and state-founded initiatives in rural/remote regions.

12. Implications of the COVID-19 Pandemic: A New Frontier for Digital Inclusion

At the time of writing, we are in the early stages of the COVID-19 pandemic. Yet already we see the widening gap between the digital haves and have-nots that is dramatically amplified by this global health crisis. As the months of pandemic unfold, we will no doubt see governments across the Americas and the Caribbean begin to grapple with emergent policy to better connect the digitally disenfranchised.

Until they do so effectively, however, the digitally disadvantaged will be de facto excluded from potentially life-saving resources including access to public health information, time-sensitive governmental directives, and telemedicine. Those without quality access to digital resources and the skills to use them cannot avail themselves of critical digital resources--this new gap will have profound implications for all life realms. Those without digital resources will be at greater risk for exposure to the virus as they must acquire food and medication in person because they cannot avail themselves of online shopping and digital delivery services that allow the digitally resourced to better self-isolate and shelter in place.

In addition to very real health and safety risks, there are long-term ripple effects from the virus for the digitally disadvantaged that will wreak hardship to a degree that we cannot yet imagine in these early stages of the age of COVID-19. Financially, while the digitally advantaged telecommute, work from home, and zoom together, those who cannot telecommute may lose their jobs, suffer insurmountable financial devastation, and helplessly witness any fingernail hold on economic well-being evaporate due to mounting bills and diminished income. The economic devastation unleashed by the COVID-19 pandemic will also have long-term impact in the workforce in terms of job-loss divides (Equipos Mori, 2020). For those far from family and physically distant from support networks, the emotional ramifications of these blows will also be suffered in social isolation while locked down at home. Emotionally, the digitally disadvantaged will also suffer the effects of social isolation to a much greater degree than their resourced counterparts who can better maintain contact with family, loved ones, and social networks on a variety of digital platforms, apps, and devices.

This will also hold true for children whose schooling and educational socialization have been abruptly curtailed to stop the spread of the virus. While some schools and educators scramble to provide distance learning and e-education, even their best efforts will not be enough unless students benefit from coordinated and large-scale programs like Ceibal in Uruguay. Without such programs, those children who lose months of formal education and who lack digital resources will likely fall behind their resourced peers who can turn to e-education resources,

connectivity, devices, and skills-learning at home. These educational disruptions may create generational lags with lifelong effects.

In closing, the propagation of the COVID-19 pandemic across the Americas and the Caribbean exposes the different degrees of social and digital fragmentation within this region. Simultaneously, the crisis reinforces the need for rapid-response and long-term policy solutions to guarantee the right of access to the internet for all to meet every social, educational, work, and health need. Future research must explore these new frontiers in digital inclusion, but now—more than ever—we need digital inclusion for all the world's population as society is being radically transformed by the COVID-19 pandemic.

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Conflict of Interests

The authors declare no conflict of interests.

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